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ELECTRICAL WORLD AND ENGINEER.

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NEW YORK, SATURDAY, MAY 14, 1904.

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### VISITORS FROM ABROAD.

It is interesting to note that provision is being made betimes by the American Institute of Electrical Engineers for the reception of the visitors from abroad who will attend the Electrical Congress in September. It is true that the Institute has its annual meeting in this city next week, but interest is concentrated more particularly on the important work to be done later in the year; and we are encouraged to note that a number of European engineers and others may be expected. In fact, according to cable advices received from President Gray, of the British Institution of Electrical Engineers, its contingent is already one hundred strong, and other large delegations are known to be preparing for the voyage. All this promises great success for the Congress, and is also to be hailed as a sign of a desire to become better acquainted with this country and its development. American engineers are far better acquainted with Europe than European engineers are with America, and it is for the benefit of all that the inequality should be redressed. There cannot come too many from abroad this year, and the heartiest welcome awaits every one. In fact, it promises to be so hearty we may have to mitigate its rigors a bit for those who are not accustomed to jump around 500 miles a night in sleeping cars.

### STREET RAILWAY MUNICIPAL OWNERSHIP.

The recent balloting in Chicago on the subject of municipal street railway ownership and operation will doubtless lead to a general agitation of that issue, at least where politicians think that it may be to their advantage to bring it into the field of practical politics. We have some sympathy with the general feeling of irritation that can be aroused by a prolonged wrangle with transportation companies punctuated by strikes and riots, but the merits of the controversy which led to the action in Chicago are neither here nor there; they are utterly inconsequential in the present issue. Nor do we consider the failure or success of municipal tramway enterprises abroad of any particular consequence. If they have uniformly failed, so much the worse for them; if they now and then succeed it is to the personal credit of the administrators rather than to the glorification of the principle. We are not so deeply rooted in pessimism as to hold that nowhere upon the orb of the earth can a municipal transportation enterprise be operated with honesty and economy, but we do submit that the past record and present character of municipal administration in Chicago and in the cities of this country apt to follow in the footsteps of that city, are such as to foredoom the result of any experiment made.

The current demand upon tramway companies is in its essence a demand for reduced fares. The several propositions brought to the front may bear either directly or indirectly upon that purpose, but they all come ultimately to the same issue. Adequacy of the accommodations is sometimes a subject of discussion, but upon this matter the tramway companies and the citizens soon meet upon common ground and work together. Attempts to lower the customary five-cent uniform fare meet, however, with determined opposition. The difference between four cents and five cents is on its face trivial, but it aggregates twenty per cent. of the gross receipts of a tramway company, and a three-cent fare would cut the gross receipts forty per cent. In theory some allowance would have to be made for increased traffic at the lower fares, but it has yet to be shown that the gain would be material. On the relatively long hauls there is small reason to expect much increase of patronage, and even on the short hauls

the gains would be small unless a complete zone system with graded fares were adopted, and this in an American city would be unpopular. There are few commercial enterprises that can stand a cut of even twenty per cent. in their gross income unaccompanied by any reduction of expenses. Even granting that some urban roads are grossly overcapitalized and that their earnings upon the actual cash invested are very large, yet a loss of twenty to forty per cent. in gross earnings would be disastrous. The zone system will probably have to be tried sooner or later as a means of cutting fares, but we think a very short experience with it will be sufficient for the American public.

As to municipal ownership itself, its only excuse for being is a desire to obtain for the public in one form or another the profits of the enterprise. Practically it stands for reduced fares with all the financial difficulties thereby implied. Its real reason for existence, however, is far less innocuous than its nominal excuse. Graft is written large all over any municipal tramway scheme. As a source of jobs and miscellaneous swindling, a municipal tramway in an American city would be in a class quite by itself. The number of employees involved is large, the annual supply bills are large, and the pickings and stealings would be upon a scale of magnificence difficult to equal. And does any sane man suppose that such opportunities would be neglected even for a single season? All that dishonest officials now get from the bland almoners of corporate bounty would be only as a drop in the bucket compared with the results of municipal ownership in any American city. If Chicago really desires to inaugurate a carnival of graft the preliminary steps now taken are emphatically in a suitable direction. Fortunately for Chicago and the country at large, further steps will be more difficult, and there will be time for the sane second thought of honest citizens to come to the rescue. We cannot seriously believe that the metropolis of the West will place itself definitely upon a platform of which "Millions for Graft" is the one conspicuous plank.

## ELECTRIC AUTOMOBILES.

It has not escaped general notice that in the large automobile parade held in this city recently, a considerable proportion of the industrial vehicles were of the electric character. In other words, nearly all of the 80 or 90 commercial vehicles in line were of the electric type, and it is matter of common observation that very few of the industrial automobiles seen hereabouts are other than electric. In this category we do not include the cabs and hansoms of the electric type, which are also so numerous, and which apparently have very little competition from gas or steam automobiles of the same type. Whatever may be the status of electricity in regard to pleasure automobiles, it certainly seems to be holding its own in doing the work of the world, and in the long run we think that after some of the craze for fancy automobiling has died out this condition will not be altogether to the disadvantage of electricity.

Meantime we believe that the central stations in this country can do a great deal to foster and encourage the use of electric vehicles, not only in supplying current, but in operating vehicles of this character themselves. We are glad to call attention to the fact, for example, that the New York Edison Company has in its own service just about a score of these vehicles, not all but mostly of the industrial type, and all of them employed in facilitating the service of the company; some in transporting the officials and inspectors from point to point; some in handling lamps and supplies; some in conveying heavy material, and some in such work as hauling in underground cable. In fact, a case came to our notice recently where 4,400 ft. of high-tension cable was safely hauled in in a ten-hour day and 500 ft. in 18 minutes. It is by applications of this kind that central station companies not only give an admirable example to the public, but tend to build up their own business in a department which should afford a field of very large consumption of current. The Boston Edison Company has also done admirable work in this field, and we believe the convention in that city this month could well devote, and profitably, an hour or two to the general subject.

## HARNESSING THE HUDSON.

We are now glad to be able to give our readers, supplementing data given last year, a rather detailed account of the immensely interesting power developments in the region around Albany. The generating plants for this important network, distributing power to all the electric systems in an area of more than 600 square miles, have already been fully described in our columns, and the present article relates merely to the utilization of that power at various points in the territory reached. This work, involving the displacement of steam in stations doing all sorts of work and long established, required no small amount of engineering ability, for it is always easier to lay out a great system *de novo* than to adapt a new transmission plant to the various exigencies of a heterogeneous electric service already long in business. In such a task there are likely to be required a wide variety of compromises, and the warring demands of various customers are apt to stimulate the ingenuity of the engineer. The details of a group of sub-stations make instructive reading, but they seldom pulsate with the vital interest that inspires editorial comment. In the mass, however, one can find occasional bits that rise above the plane of constructive common-place and illustrate methods or tendencies which have more than a local importance. In the present instance there are three salient features of the system which separate it from many recent plants which we have described. In the first place the frequency is 40 periods, as in the original Mechanicville station, a periodicity which is unusual in this section of our country. Second, there is a considerable use of high-voltage, three-phase cables not only underground, but for crossing the bed of the Hudson. And finally there is in the sub-stations a very wide use of synchronous motors, in utter contravention of the practice in some plants of the past few years.

As regards the question of frequency, the three-phase system started out both here and abroad at a periodicity of 40 periods to 50 periods, in the days when ordinary alternating plants ran at 120 periods to 130 periods. The lower frequency enabled one to run incandescent lamps admirably and gave also good motor service. At 50 periods, certainly, alternating arc lamps could be used with good results and the frequency was well suited to mixed service. But a new line of transformers was required, and presently in a rather rash attempt to make the old transformers answer for the new apparatus everybody had a try at a frequency of 60 periods to 70 periods. This process of putting new wine into new bottles led to the customary result, but by the time a new line of transformers had replaced the misused ones which had burned out, many polyphase plants had gone in at the increased frequency. By this time, too, the rotary converter was in full swing, and a sharp demand had sprung up for low-speed motors. Under the pressure thus created, inasmuch as rotaries and low-speed motors are not easy to build at 60 periods or so, a new line of apparatus at 25 periods came into use. Just why this frequency which is just too low for the advantageous working of incandescent lamps was chosen it is hard to say—possibly because some engineers thought that in the rotary converter they saw the finish of alternating distribution circuits. Now, the plant under consideration has come back to first principles at 40 periods, and apparently without inconvenience, save in the matter of frequency-changing for some of the arc service; and merely as a matter of saving changes, it would appear, for part of the incandescent circuits. Rotary converters up to 600 kw output are operated at 40 cycles and we do not imagine that the slightest trouble will be experienced with them. It is difficult to predict the trend of frequency, especially since alternating-current motors for

railway service are beginning to be introduced, but it certainly has been demonstrated that it is unnecessary to go to extra low frequency merely on account of rotaries.

The cable feature in this plant is of particular interest. It was necessary to use underground lines in going into Albany. This was a comparatively straightforward job, and cables at the pressure used, about 10,800 volts, had already been made; but, still, the performance of these paper-insulated, lead-covered cables at so high a pressure will be exceedingly well worth watching. We are inclined to the opinion that they will answer the purpose well. In entering Troy it was necessary to cross the Hudson, and a choice had to be made between a high span from steel towers and an underwater cable. Just what determined the choice of the latter we are unable to state definitely, but we are glad that the cables were chosen, if merely for their value in experience. Like the underground cables, these are paper-insulated, lead-covered cables, but armored with galvanized iron laid over jute. Barring danger from lightning, lessened by careful local protection by lightning arresters, the cables run no especially severe risks, and their performance in steady use will be immensely instructive. So little is known about the working of high-tension cables under water that every instance of their use is of direct importance to the art.

Finally, we must note the regular use of synchronous motors in the various sub-stations. Two or three years ago the trouble from "hunting" in these machines had the bulk of the engineering profession pretty well scared, and many enormously big induction motors were being installed to avert the difficulty. The big induction motor is a beautifully simple machine, but it is not altogether a good thing to encourage in a large transmission system, and we are glad to see that the synchronous motor has been mastered sufficiently to allow its free use in situations where it can be of value. One other point in this system awakens a lively interest—the use of automatic three-phase regulators in one of the sub-stations. It is only recently that such apparatus has been put out, although it has been greatly needed. If thoroughly successful, and there is no good reason why it should not be, one of the standing difficulties in long-distance power transmission will have been obviated. Hand regulation is effective enough, but good automatic regulation is greatly to be desired for all classes of service.

## THE MAGNETIC OBSERVATORIES OF THE UNITED STATES.

The United States Treasury Department, controlling the United States Coast and Geodetic Survey, has recently issued a very entertaining buff book marked "Appendix No. 5 of the Report for 1902," reciting the conditions of the United States magnetic observatories in operation July 1, 1902. Careful records of terrestrial magnetic elements have been compiled during the last three centuries. The results acquired are of great scientific value, and indicate the possibility of important utilitarian application in the future, when they shall be better understood and interpreted. A few years ago the capitals of nearly every important country had a magnetic observatory in full operation, recording from moment to moment the direction and intensity of the earth's magnetism. Thus, London had Kew Observatory, the United States had the Washington Naval Observatory, Canada had the Toronto Observatory, etc.

Alas for the mutability of magnetic forces! The all-invading trolley car has been more fell than hunger, anguish or the sea. The magnetic observatories have been put out of business by the central stations. Kew, Washington, Toronto and Paris have all banished their observatories to fresh fields and pastures new. Kew fought hard against the deadly trolley and invoked Parliament and City Council, but finally packed up her instruments. Numerous other observatories have followed a similar flight. The magneticians all ask the same question: "Where can we erect our altars and set up our instruments out of the ruthless reach of the desecrating trolley?" The Emperor William of Germany, reposing upon the divine right of kings and kaisers, uttered a royal decree forbidding trolley cars to come within 16 km. of his Potsdam observatory. This solved the difficulty for the two observers and the six suspended magnets at Potsdam. But the various thousands of disinterested German citizens in the neighborhood protested, in favor of rapid transit. According to the report, there has been some talk of taking back the decree and taking away the observatory. The United States has joined in the exodus. The Washington Observatory gave up the struggle. There are now four United States magnetic observatories that the experts consider safe for the time being from the trolley cars. One is in Sitka, Alaska, "near the new Russian cemetery," a quiet, remote place. The second is "on an immense coral plain" 20 km. west of Honolulu in the Island of Hawaii. The third is in Baldwin, Kan., 21 km, in an air line.. south of Lawrence, Kan. This, however, is but a temporary site, and, if trolleys should come the equipment can be shipped quickly. The fourth is at Cheltenham, Md., on the grounds of the Maryland Reform School. Two local passenger steam trains pass Cheltenham daily. The report states that the land in this region, while in a flourishing condition before the civil war, when slaves were available for tilling the soil, is now so undesirable that so far as can be seen at present, there will be little inducement to run electric car lines into this region. The civil war was thus evidently not in vain from one special viewpoint.

Great pains have evidently been taken with the construction of the buildings for these observatories, so as to maintain a nearly uniform internal temperature at the magnetographs. This thermal insulation has been provided by using multiple walls and large thicknesses of dry sawdust. Three thousand sacks of sawdust are stated to have been used in the Sitka Observatory alone. The thermograph records for Cheltenham Observatory inside and outside the building during a week show that while the external range of temperature during that time was about 50°, the internal range was about 1°. It is interesting to observe that the apparatus employed for making and recording the observations differs but little from that employed thirty years ago. Of course, it is only reasonable to expect that observations and apparatus may crystalize after three centuries of use. Moreover, there is one advantage of uniformity of type, in that all observations may have a greater degree of approximation. On the other hand, it seems strange that portable magnetometers, on electromagnetic lines, have not come into general use for rapid work in traveling. The absence of a proper scientific terminology in the magnetic c.g.s. units reveals itself in the work of the department, which has created a unit and name of its own. The earth's horizontal intensity, if interpreted as $\mathfrak{H}$, a magnetic force, would be expressible in gilberts-per-centimeter; or, if interpreted as flux density $\mathfrak{B}$, would be expressible in gausses. Not having the gilbert-per-centimeter, the tabular results are "expressed in gammas." The gamma, a unit of magnetic intensity, invented and christened by the department, is 1/100,000 of one gilbert per centimeter. The results are expressed, as a rule, to five significant digits, and are probably conveniently written in terms of a unit of that particular magnitude. A more conformable method, with respect to other branches of magnetic science, would be to shift the decimal point, and express the result in milligilberts, or microgilberts-per-centimeter as $\mathfrak{H}$, or if the values may be interpreted as $\mathfrak{B}$, to write them in milligausses or microgausses. The adoption at the 1900 International Electrical Congress of the name gauss to designate the c.g.s. unit of flux density, renders particularly inappropriate the invention and use by a government bureau of a new unit and new name. That it will survive in view of the international action above noted is improbable, and in the meantime it will give rise to confusion.

## National Electric Light Association.

Mr. Charles L. Edgar, president of the National Electric Light Association, spent two or three days in New York last week making final arrangements for the convention to be held in Boston May 24-27. Owing to President Edgar's energetic methods 25 papers and reports are now in type, and it is expected that copies will be distributed to those members who have announced their intention of attending the meeting, reaching them before they leave home, and thus enabling them to prepare themselves to discuss the papers intelligently.

Mr. Hodskinson, chairman of the committee on hotel accommodations, has succeeded in getting replies from every member company, stating whether or not a representative would be in attendance, and from these replies it is estimated that the representation will be far in excess of that at any previous meeting. Most systematic arrangements have been made for the reception and registering of delegates, and a plan of distributing and looking after the papers has been formulated which promises to make that part of the convention routine run very smoothly.

## Heavy Travel in Greater New York.

A report of the New York State Railroad Commission covering the year ending February 29 shows the number of cash passengers and also the number of transfer passengers carried by the local traction systems as follows:

Interborough, 273,133,242, increase 37,318,852; car mileage 60,730,337, increase 12,870,859.

New York City Railway (Interurban), 397,644,829, increase 144,311. On transfers there were 166,310,453 passengers carried, an increase of 11,435,049; car mileage 62,412,527, increase 954,666. The number of passengers carried in the first three quarters of the year increased 5,129,287, but the loss in the winter months practically offset this.

Brooklyn Rapid Transit, 285,725,986, increase 23,280,423. On transfers 55,146,001 passengers were carried, an increase of 3,772,959; car mileage 54,394,315, increase 3,025,769.

Coney Island & Brooklyn, 33,129,812, increase 967,765. On transfers 6,016,455, increase 88,063; car mileage 6,212,762, increase 43,854.

Union Railway, 21,273,870, increase 1,998,543.

The chief item of interest is the rapid gain on the Interborough elevated system as compared with stationary conditions on the Interurban surface system in New York. Probably the latter will improve when the fearful mess and obstruction of the underground railway work is cleared out of the way.

## Annual A. I. E. E. Meeting.

A departure will be made this year from past practice in relation to the annual or business meeting of the American Institute of Electrical Engineers, which will have somewhat the character of a general meeting. The meeting will extend over two days, with a programme covering the morning, afternoon and evening of the first day and the morning and afternoon of the second day.

The first session will be called to order at 10.30 A.M. Tuesday, May 17. During the morning the following papers will be presented:

"Predetermination of Sparking in Direct-Current Machines," by W. L. Waters; "Effect of Self-Induction on Railway Motor Commutation," by E. H. Anderson; "On the Calculation of Line Batteries," by W. E. Winship.

At 1 P.M. there will be a luncheon, followed by a visit to the Rapid Transit Subway. At 8.15 P.M. a meeting will convene at which the annual reports will be read, announcement made of the results of the annual election, to be concluded by a paper by Mr. B. G. Lamme on "Data and Tests on a 10,000-Cycle Alternator."

At a morning meeting on Wednesday the following papers will be presented: "Notes on Fly-Wheels," by H. H. Barnes, Jr.; "The Single-Phase Induction Motor," by Prof. W. S. Franklin; "Wave Form Variations of a Long-Distance Line," by Prof. Geo. H. Rowe. At 1 P.M. there will be luncheon, after which the library and technical laboratories of Columbia University will be visited.

It is announced that the general meeting of the Institute will be held at the St. Louis Exposition during the week ending September 17, 1904, at which no unsolicited Institute papers will be presented or discussed.

## Convention of Texas Electrical Associations.

The Southwestern Gas, Electric & Street Railway Association and the Southwestern Electrical Association held a joint annual convention at Dallas April 25, 26 and 27, at which it was decided to unite the two organizations under the name of Southwestern Electrical & Gas Association. Those eligible for active membership in the new association are companies, firms or individuals engaged in the manufacture of gas, generation of electricity, operation of electric railways, telephone exchanges and telegraph lines. The officers-elect of the new association are as follows: President, J. F. Strickland, of Waxahachie; secretary, F. E. Scovill, of Austin, and treasurer, A. E. Judge, of Tyler, Tex.

Most of the first day's session was occupied with discussions as to the benefits and evils of telephone competition. This discussion grew out of a paper read by Mr. J. E. Farnsworth, general manager of the Southwestern Telegraph & Telephone Company. Mr. James Moroney, of Dallas, favored independent companies and pointed out the benefits to be derived through their service. At the conclusion of the afternoon session the members were tendered a trolley excursion around the city. In the evening various entertainments were provided for the visitors. Forty candidates were put through the initiation of the "Sons of Jove," after which a smoker was held.

Among the papers announced on the programme were "Municipal Franchises," by John W. Shartell, president of the Metropolitan Railway Company, of Oklahoma City, and "Advantages of Combination of Gas & Electric Plants," by R. R. Stitcher, of the Cleburne Gas & Electric Company, of Cleburne, Tex. Mr. H. F. MacGregor, vice-president of the Houston Electric Company, read a paper entitled "Accidents and the Damage Suit Industry." Mr. MacGregor referred to the growing evil of damage claims based on the slightest pretext and frequently on fraud, and gave some advice as to the management of this department of companies. He stated that the increase in the amount of damages paid for the work of damage suit bureaus in magnifying slight injuries and prompted fraudulent claims until finally the matter has attracted the attention of the Railroad Commission of the State of Texas to the injustice. Every member of the Association, he said, should enlist in the campaign of exposure of fraudulent claims. Corporations have suffered from the administration of justice in Texas, not so much from the intent of juries not to reach the justice of the case, but from perjured testimony that creates confusion; and the inaction of the judges.

## Western Union and the Poolrooms.

The relations of the Western Union Telegraph Company to the pool rooms which are carried on contrary to law in New York, but which it furnishes a special service, continue to attract considerable attention and excite comment. President Clowry, of the company, in a public statement, says: "In view of recent occurrences I have to say that I do not believe any fair-minded person will suppose that the Western Union Telegraph Company would willingly become party to any criminal undertaking. While we cannot put ourselves in the attitude of passing upon the morals of the people for whom we transmit messages, or to whom we lease wires, we are quite ready to co-operate with the constituted authorities in their efforts to suppress crime, and we will go just as far in the direction as, under the advice of our counsel, we are permitted by law to go. Surely, no one will expect us to enforce one law by breaking another law. If the authorities will give us evidence upon which we can prudently act, they need have no fear that we will not aid them. Whenever those charged with the enforcement of the law will furnish this company in writing with the names of persons who are engaged in keeping unlawful pool rooms, and specify the places where the pool rooms are located, and state that they have decided to take action to close them up, if they request the telegraph company to cease the transmission of intelligence to such places we will promptly comply with such request, even though the public authorities should prove to be mistaken and the telegraph company be thereby involved in litigation and liability."

The attack is now being leveled at the New York Telephone Company as well, on the ground that it also gives service in the pool rooms; and the accusation is made that the attitude of Col. Clowry is hypocritical. Several of the papers print in "caps" the names of the directors of both companies, as men willing to make a special profit out of business with gambling hells.

## Hudson River Power in Albany, Troy and Schenectady.

ELECTRICAL supply in Albany and Troy, N. Y., is now drawn from Spier Falls on the Hudson 40 miles up stream, and from the falls at Mechanicville, 15 miles away. This transmitted energy is supplied to the local companies in Albany and Troy by the Hudson River Water Power Company, and the contracts call for the immediate delivery of a maximum of 6,000 hp in each city.

The water power plants at Spier Falls and Mechanicville, and the transmission lines, switch houses and sub-stations of the Hudson River Water Power Company have already been described in previous issues of the ELECTRICAL WORLD AND ENGINEER, dated June 27, October 24 and 31, and November 7, 1903.

Two three-phase transmission lines from Spier Falls, and one three-phase line from Mechanicville, run to the Watervliet sub-station of the Hudson River Water Power Company, which is just across the Hudson from the city of Troy. Each of these three circuits is made up of three bare solid copper wires, size 3/0 B. & S. gauge. Energy delivered to the line at Spier Falls at about 30,000 volts reaches the Watervliet sub-station 35 miles away at about 26,500 volts, and the current from Mechanicville comes into the same sub-station at approximately 10,800 volts. Transformers at the Watervliet sub-station reduce the 26,500-volt current from Spier Falls to the 10,800-volt pressure, and the energy from both Spier Falls and Mechanicville is then transmitted from Watervliet at this latter voltage to the local sub-stations of the lighting and traction systems in Albany and Troy. The energy from Spier Falls is reduced in pressure from 26,500 volts to 10,800 volts at Watervliet because it is necessary to cross the Hudson River with a cable in order to reach Troy, and to run underground in entering Albany. It was not thought desirable to use as high a pressure as 26,500 volts in the submarine and underground cables necessary for these purposes. At Mechanicville the current is developed at a little above 10,800 volts, and the reduction of the 26,500-volt current to this lower voltage at Watervliet brings both sources of energy there to the same pressure.

At the Watervliet sub-station the equipment includes nine transformers rated at 1,000 kw each, which are arranged in three groups for the transmission circuits above mentioned, and reduce the voltage from 26,500 to 10,800. From Watervliet two 10,800-volt, three-phase overhead circuits run to another sub-station of the Hudson River Water Power Company about four miles distant near the city limits of Albany and called the Albany sub-station. The object of this sub-station is to regulate the pressure of the two 10,800-volt circuits, connect their overhead wires with underground cables, and to reduce the voltage of a part of the energy for local distribution. This sub-station is 55 ft. 9 in. by 31 ft. 6 in. on the ground, partly one and partly two stories in height, and has a basement underneath its entire area. In structure the walls of this building are brick, the floor of the basement concrete, the upper floors concrete on steel I-beams, and the roof tile, also supported by I-beams.

The central portion of the basement forms an air pressure chamber over which the transformers on the first floor are located. On this first or main floor there are also located two so-called I. R. T. automatic regulators of General Electric make rated at 300 kw each. Each of these regulators is connected to one of the 10,800-volt, three-phase circuits, has capacity to raise or lower the voltage thereon by 7.5 per cent., and is designed to maintain a constant voltage to within one-half of one per cent. Room is provided over the air pressure chamber for nine transformers of 500-kw each, these transformers to be arranged in three groups and reduce the voltage from 10,800 to 2,300 for local distribution. From these transformers the 2,300-volt circuits lead to a switchboard on the same floor that controls the local lines. Two motor-driven blower sets occupy a part of the floor space over the air pressure chamber, and maintain the pressure that forces air through the transformers and the I. R. T. regulators.

In front the sub-station is two stories high above the basement, and the two-story portion is 10.5 ft. wide between 12-in. brick walls and its length occupies the entire width of the building. Into this front end of the sub-station, which is thus separated by a brick wall from the remainder of the building, come the bare overhead transmission lines. For the entry of these lines nine circular openings,

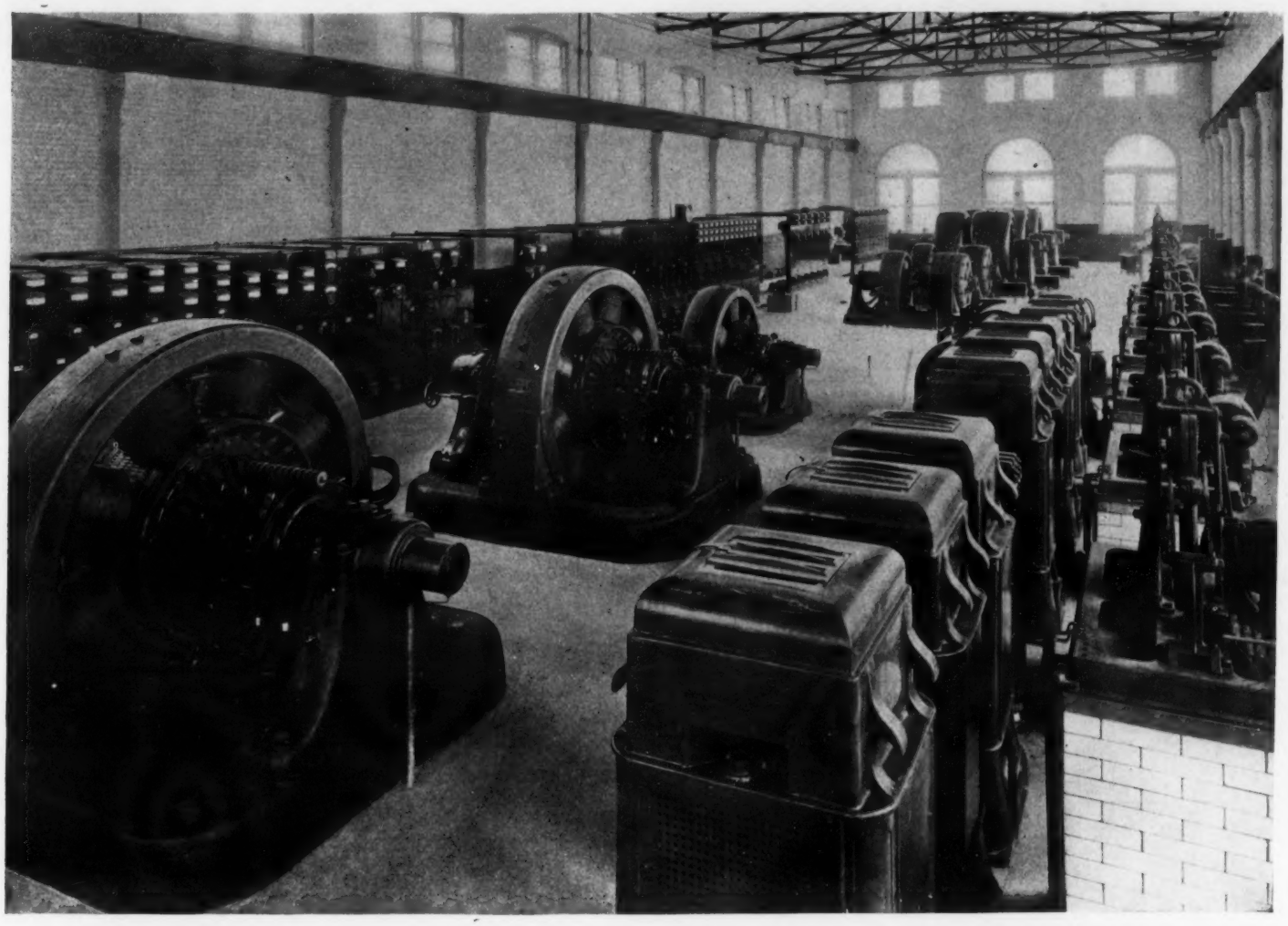


FIG. 1.—VIEW OF INTERIOR OF SUB-STATION OF SCHENECTADY RAILWAY, SCHENECTADY, N. Y.

each 15 in. in diameter, were made in the brick wall along the same horizontal line and with centers 21½ in. apart. These openings in the brick wall are protected from storms by an extension of the roof, which is about 2 ft. above the openings, and by a cement wall 2 in. thick and 2 ft. outside of the brick wall that drops from the extended roof of the front part of the building to the lower roof of the rear part.

In this cement partition or wall there is a row of circular holes opposite to the holes in the brick wall, but each hole in the cement wall is only 10 in. in diameter. After passing through these two sets of openings the nine wires of the three transmission circuits enter single-pole, double-blade knife switches that connect each wire with a bank of lightning arresters and with a 10,000-volt type H oil switch

FIG. 2.—DOCK STREET SUB-STATION, SCHENECTADY.

of General Electric make. From these oil switches two of the three circuits go through other knife switches to the two I. R. T. regulators, thence through still other knife switches to 15,000-volt, type K oil switches of General Electric make, and from these K switches to more single-pole, double-blade knife switches that connect with static discharges and underground cables. The third 10,800-volt circuit, after passing through an H oil switch with knife switches on each side, goes to the transformers that lower the pressure to 2,300 volts for local distribution.

All three of the 10,800-volt circuits, after leaving the H oil switches, connect with duplicate sets of bus-bars by means of which any one of these circuits can be joined to either I. R. T. regulator, or to the transformers. The lightning arrester cells, the static dischargers and both the types of oil switches are all located in the front end of the sub-station on two floors, and are separated from the remainder of the sub-station by the brick wall already mentioned. The conductors between these several switches and bus-bars are bare copper, and like the knife switches are supported at the tops of large porcelain insulators like those used outside on the line. Each of these insulators is mounted on a wooden pin that is 9 in. long above the shoulder, and that is cemented into the brick wall of the building. The clips of each knife switch are attached to a cast-iron cap that is cemented to the top of one of the insulators just named. This method of insulation is highly effective.

After leaving the K oil switches the 10,800-volt circuits connect with underground cables that run to the station of the Albany Electric Illuminating Company on Trinity Place. From the above sub-station of the Hudson River Water Power Company to the station of the Albany company the distance is about two miles, and twelve standard clay ducts, each 4 in. in diameter, have been laid in Portland cement concrete between these two stations. For present purposes two three-phase cables have been laid in these conduits in order to deliver the 10,800-volt current at the Trinity Place station. Each of these cables contains three 3/0 stranded copper conductors, is insulated with paper, and covered with a lead sheath ⅛ in. thick. At the station of the Albany company a new fire-proof addition has been built to receive the 10,800-volt underground cables and contain the high-tension switching and transforming apparatus. This addition adjoins the brick wall that forms one side of the main steam power station, has brick walls one story high, measures 32 ft. 4 in. by 37 ft. 4 in. outside, and has a concrete floor and a concrete cemented roof, this latter being supported on steel I-beams. A 15-ton traveling crane sweeps the entire space included within the addition save what is devoted to the switching apparatus and bus-bar compartments.

On the distribution system of the Albany company the load consists of open direct current and of enclosed alternating arc lamps, incandescent lamps on two-phase circuits, and of direct-current motors. The entire load has previously been carried by steam power at the Trinity Place station, and the plan in the application of transmitted water power in the system was to abandon the regular use of steam and yet make no changes in the character of the connected loads. To avoid any such change it was necessary to continue the operation of the 9.6-amp., direct-current arc dynamos and of two-phase, 60-cycle alternators, also to substitute rotary converters for the abandoned direct-current, 500-volt generators that had been used to carry the motor load.

On entering the new addition of the Trinity Place station the two underground cables connect with oil switches and high-tension bus-bars of Westinghouse make. From these switches and bus-bars connection is made with four banks of transformers all located in the fire-proof addition to the old station. Each of two of these groups of transformers consists of three units rated at 200 kw, making 600 for the group. These three transformers reduce the 10,800-volt, three-phase current to 375 volts for a 500-kw, 550-volt rotary converter that is located in the main station. There are thus two of these converters with a combined capacity of 1,000 kw for the load of direct-current motors. Each of the other two groups of transformers consists of two units rated at 400 kw each and connected Scott fashion so as to change the current from three-phase to two-phase, while reducing its pressure from 10,800 to 2,300 volts. This 2,300-

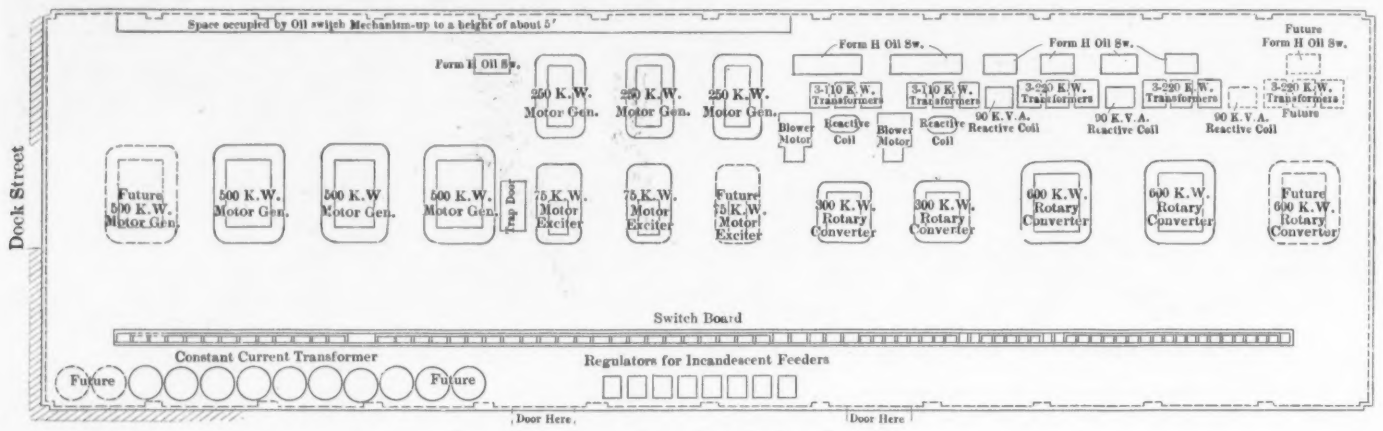



FIG. 3.—PLAN OF DOCK STREET SUB-STATION.

volt current passes to the switchboard for distribution lines in the main part of the station, which is separated from the transformers by a brick wall. With the 2,300-volt, 40-cycle current thus obtained the distribution circuits for incandescent lamps and induction motors are supplied.

The old station contains a long main shaft to which the arc dynamos and 60-cycle, 2,300-volt alternators have been connected by belts in the past, the shaft itself being driven by steam power. The steam engines have been uncoupled from this shaft, though the connection can be quickly remade if it becomes desirable, but the arc dynamos and one 225-kw alternator remain belted to it. Near each end of this line of shafting and directly coupled therewith are synchronous motors, each rated at 550 kw, 10,800 volts and 343 r.p.m. These motors draw their current from the high-tension switches and bus-bars in the new addition to the station, and the same is true of

a third motor of like voltage and capacity that is direct-connected to a 225-kw alternator at each end of its shaft. This third motor and the two alternators to which it is coupled operate at 480 r.p.m., and the alternators develop two-phase, 2,300-volt, 60-cycle current. These alternators are devoted to the circuits that operate commercial, enclosed arc lamps. The transformers, rotary converters and synchronous motors just mentioned were all furnished by the Stanley Company.

Public street lighting in Albany is done entirely with open arc, direct-current, 9.6-amp. Brush lamps, and about 680 of these lamps are in use and connected to the station of the Albany Electric Illuminating Company. To the circuits of the company there are also connected direct-current motors of about 1,500 hp total capacity at 550 volts and arc and incandescent lamps of about 2,000 kw combined capacity on 2,300-volt, two-phase lines.

In order to reach the electric lighting station in Troy from the Watervliet sub-station of the Hudson River Water Power Company it is necessary that the 10,800-volt lines cross the Hudson River. A point about one mile down stream from the sub-station and nearly opposite to the lighting station in Troy was selected for this crossing, and a cable was laid in the bed of the river. Bare overhead conductors run from the Watervliet sub-station to the cable landing on the west bank of the Hudson, and there enter a small brick terminal house where they join the cables and have lightning arresters attached.

After crossing the river the cables enter a large manhole close to its east bank and are there connected to underground cables that run to the lighting station, a few hundred feet away. Two cables were used to cross the river, which was covered with a thick coating of ice at the time they were laid, in December, 1903. By means of horses the two heavy cables were dragged across the river on the ice so that they lay side by side over the location on its bed, where they were to rest, which had been previously determined, and then the ice was sawed through on each side of the cables so that they sank into position by their own weight.

Each of these two cables contains three No. 3/0 stranded copper conductors, is insulated with paper, enclosed within a lead sheath, and protected on the outside by a layer of galvanized steel wires that are laid in spiral form on a bed of jute that rests on the lead sheath. Between the 3/0 wires the thickness of paper is ½ to 9/16 in. and between each wire and the lead sheath the paper measures about ⅜ in. This insulation was tested with 25,000 and 50,000 volts applied for one hour. The lead sheath outside of the paper has a radial thickness of 3/16 in., and then comes the layer of jute or other fibrous material, which is 1/16 in. thick, and supports the armor of No. 4 Birmingham gauge steel wires. Outside of this armor the cable has a diameter of 3⅜ in. Both of the cables were made by the National Conduit & Cable Company.

At Troy the connected load on the electrical supply system includes about 15,000 incandescent lamps of nominal 16-cp rating, 296 enclosed arc lamps in commercial use, 427 direct-current, open-arc lamps for street lighting that are rated at 2,000 cp each, 40 open arcs for stores, and 125-kw capacity in direct-current motors. Dynamos for the operation of these several loads have been previously driven by steam power through a long main shaft at the Troy lighting station. In the application of the transmitted water power to these loads the steam engines were disconnected from the main shaft, and synchronous motors were installed to drive it and the several types of dynamos. These dynamos include direct-current arc machines of 9.6 amp., 2,300-volt alternators, and 500-volt, direct-current generators for the motor load. The underground cables bringing the 10,800-volt, three-phase current from the Watervliet sub-station enter the old lighting station at Troy, and this current, after passing through oil switches, goes to the 10,800-volt synchronous motors without transformation. In this way the old generating equipment at Troy is retained, and is driven by synchronous motors and water power instead of by steam engines.

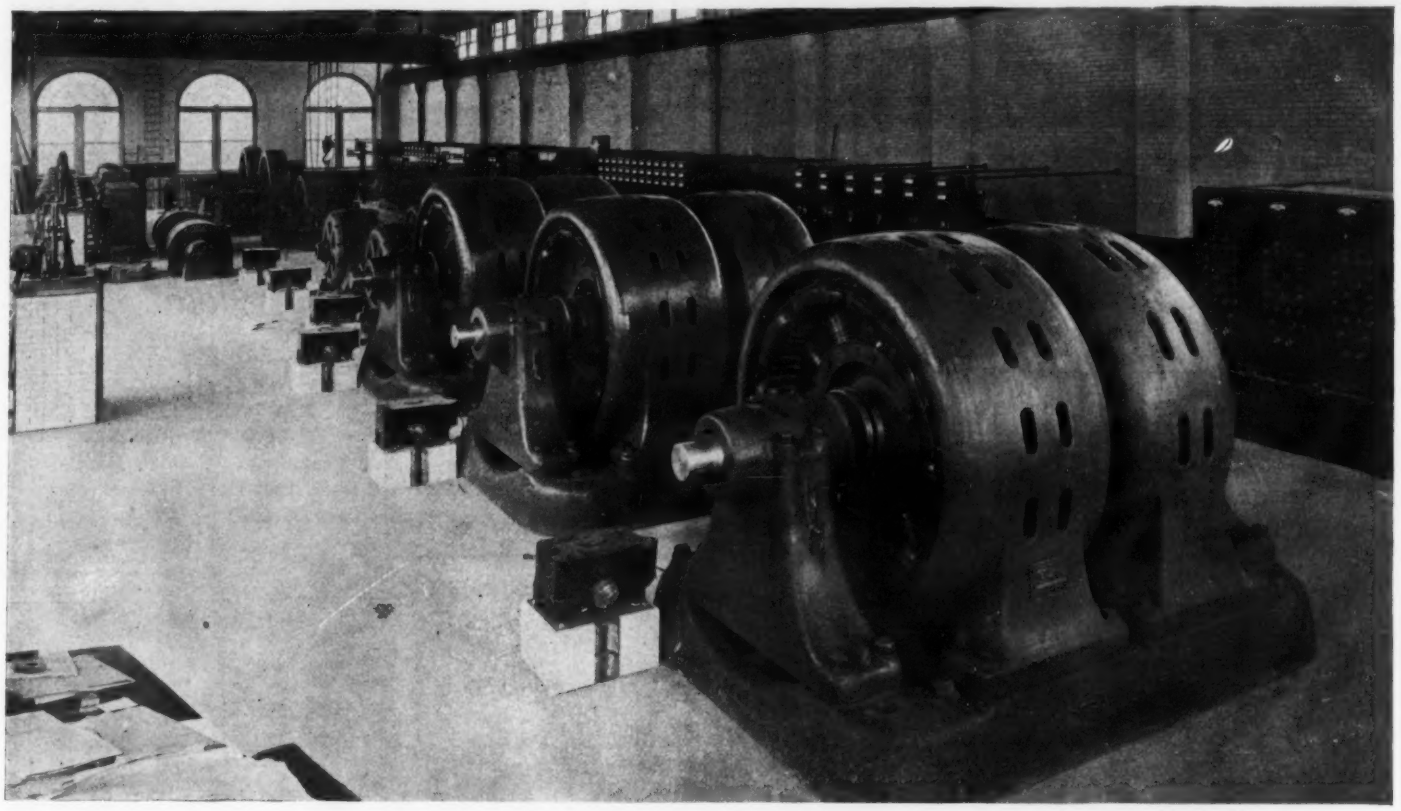


FIG. 4.—ANOTHER VIEW OF INTERIOR OF DOCK STREET SUB-STATION, SCHENECTADY.

Besides the supply of transmitted energy to the local lighting systems of Albany and Troy, as above outlined, the Hudson River Water Power Company also furnish a large part of the power used to operate the electric car lines of the United Traction Company in and between these two cities. Power for this electric railway system is delivered in the form of 10,800-volt, three-phase, 40-cycle current at two sub-stations of the United Traction Company, one located near the Watervliet sub-station of the Hudson River Water Power Company, and the other at North Albany some four miles away. At each of these railway sub-stations the 10,800-volt current from the water power plants is transformed to about 375 volts and delivered to rotary converters that supply direct current at about 550 volts. The contracts between the Hudson River Water Power Company and the Albany lighting company, the Troy lighting company and the United Traction Company look to the complete substitution of transmitted water power for steam in the entire public lighting and street railway systems in these two cities as soon as sufficient generator capacity has been installed in the great plant at Spier Falls to meet the maximum requirements at these and other points, when operated in conjunction with the water power station at Mechanicville.

The transfer of electric lighting and railway loads in Albany and

Troy to the water power system completes the substitution of energy drawn from the Hudson River for steam power in electric systems over a territory some 15 miles wide east and west, and 45 miles long north and south. This territory includes Glens Falls on the north, Troy on the east, Albany on the south and Schenectady, Ballston and Saratoga on the west. Probably no other single electric system in the United States serves an equal population over an equal area with an equal amount of power.

Transmitted water power from Spier Falls and Mechanicville also operates the electric railway and lighting systems of Schenectady, N. Y. Both of these systems are owned by the Schenectady Railway Company, and the energy for their operation is delivered through the main switchboard in the power station at the General Electric Works. Energy from steam as well as from water power is available at the General Electric switchboard, so that certainty of continuous service on the railway and lighting systems is secured without auxiliary steam equipments in its sub-stations.

As at present operated, the railway and lighting systems have three sub-stations, one on Dock Street close to the General Electric Works in Schenectady, one at Colone on the branch of the railway that connects Schenectady and Albany, and one at Latham's Corner on the railway between Schenectady and Troy. The Dock Street sub-station distributes light and power in Schenectady, besides delivering current to the railway, but the other two sub-stations carry only railway loads. When the branch of the Schenectady railway that connects that city with Ballston Spa is in operation a fourth sub-station located at the latter place will supply power to that branch.

Between the power station at the General Electric Works and the new sub-station on Dock Street there are three underground cables each containing three 3/0 stranded copper conductors. Each of these cables carries 10,000-volt, 40-cycle, three-phase current drawn from step-down transformers in the General Electric plant, and the current delivered by two of the cables is devoted to railway work, while the third supplies energy to the lighting system. From the Dock Street sub-station to that at Colone there are two circuits of three No. 1 B. & S. gauge wires each, and between the Colone and the Latham's Corner sub-stations there is one circuit of three No. 2 B. & S. gauge wires. Between the Dock Street sub-station and the city limits of Schenectady the two circuits of No. 1 wire are made up of two paper-insulated lead-covered underground cables, with three conductors each, but the remainder of these circuits, and that of No. 2 wire are bare overhead conductors. These circuits running to the Colone and Latham's Corner sub-stations transmit the 10,000-volt, three-phase current delivered to the Dock Street sub-station from the General Electric Works.

When the sub-station at Ballston Spa is in operation its energy will be drawn directly from one of the two transmission circuits between Spier Falls and Schenectady, before they reach the General Electric Works. At the sub-station just named the electric railway equipment will include two 300-kw, 550-volt, 40-cycle rotary converters to operate at 800 r.p.m. three 220-kw air-blast transformers with double secondary windings, and two 45-kw air-blast reactive coils, all made by the General Electric Company. A 2-hp, three-phase induction motor will drive a direct-connected, 35-in. blower, and a 20-hp motor of the same type will operate a Magan air compressor. At the Colone and also at the Latham's Corner sub-station, both of which have been in regular operation for some time, there are three 300-kw rotary converters supplied with energy from the 10,000-volt line through transformers and delivering direct current of about 550 volts.

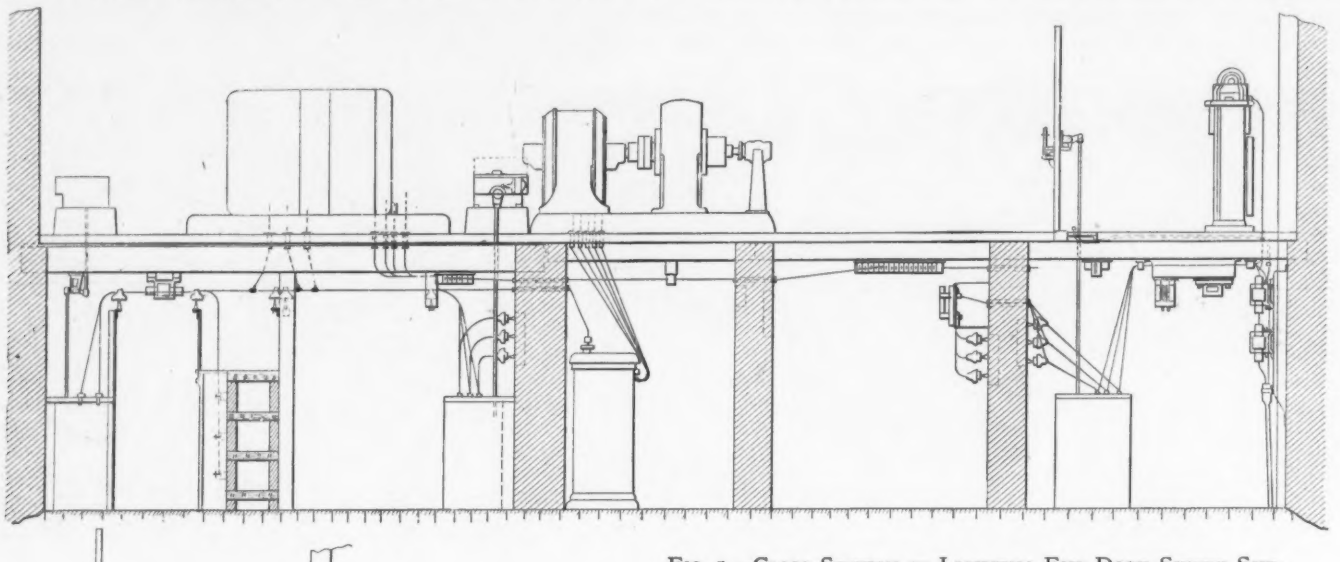
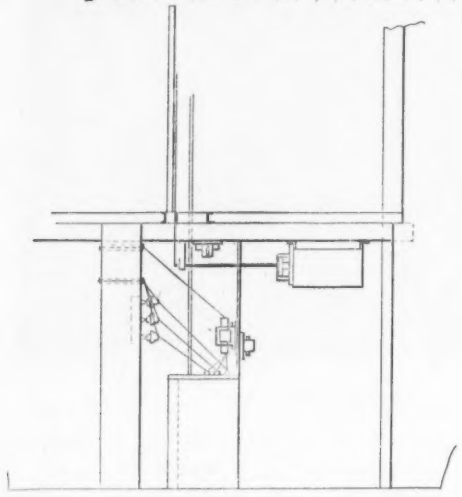


FIG. 5.—CROSS-SECTION OF LIGHTING END DOCK STREET SUB-STATION, SHOWING WIRING.



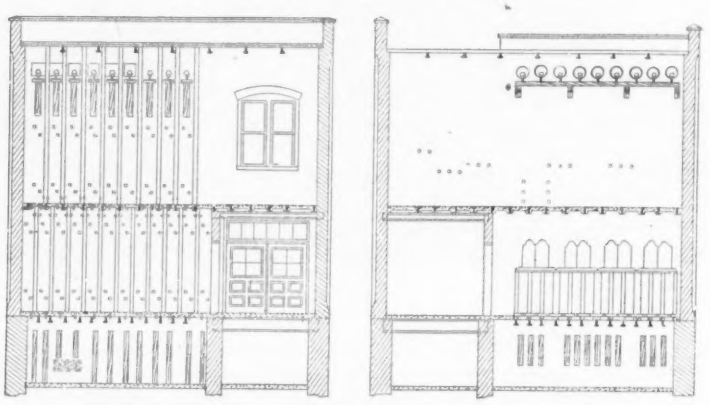


FIG. 6.—CROSS-SECTIONAL ELEVATIONS OF CELL ROOMS.

The new sub-station on Dock Street has recently been put into service to replace an old power house and sub-station nearby and carries all of the lighting and stationary motor service at Schenectady as well as a large share of the street railway load. The ground area of the sub-station is 165 ft. 8 in. by 45 ft. 2 in., and its elevation includes a high basement and main operating room or first floor above. The basement floor of this sub-station is slightly above the ground level outside because the Hudson River and Erie Canal near which it is located are liable to overflow. From ground to coping the height of the sub-station is 40 ft. 4 in., from basement floor to main floor the distance is 10 ft., and main floor to the lower cord of the steel roof trusses the distance is 24 ft. In structure the sub-station is of

stone, brick, concrete and steel, save for the three-inch plank that supports the slag covering of the roof.

Up to the level of the main floor the outer walls are of brown stone, and above this they are brick. In thickness the stone wall is

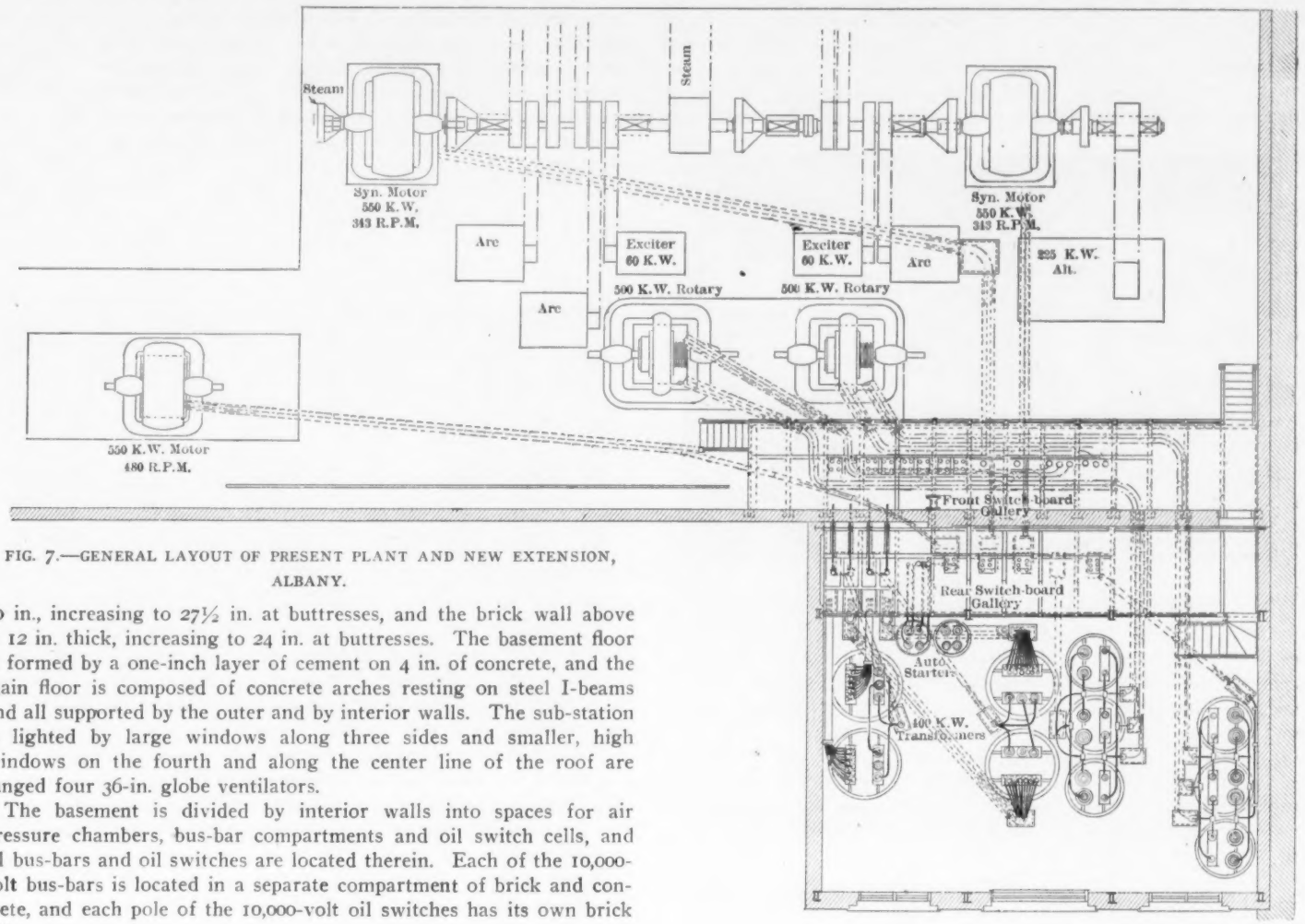



FIG. 7.—GENERAL LAYOUT OF PRESENT PLANT AND NEW EXTENSION, ALBANY.

20 in., increasing to 27½ in. at buttresses, and the brick wall above is 12 in. thick, increasing to 24 in. at buttresses. The basement floor is formed by a one-inch layer of cement on 4 in. of concrete, and the main floor is composed of concrete arches resting on steel I-beams and all supported by the outer and by interior walls. The sub-station is lighted by large windows along three sides and smaller, high windows on the fourth and along the center line of the roof are ranged four 36-in. globe ventilators.

The basement is divided by interior walls into spaces for air pressure chambers, bus-bar compartments and oil switch cells, and all bus-bars and oil switches are located therein. Each of the 10,000-volt bus-bars is located in a separate compartment of brick and concrete, and each pole of the 10,000-volt oil switches has its own brick cell.

The entire main floor of the sub-station is swept by a 15-ton traveling crane, and this crane runs over an archway at one end of the building, where teams can drive in at the basement level. The 18-in. I-beams on the side walls of the sub-station on which the crane travels are supported by the brick abutments, and these abutments are not reinforced by steel columns. On the main floor of the sub-station are located transformers, the operating gear of oil switches, rotary converters, exciters, synchronous motor-generators and the switchboard panels. Along one-half of the main floor the railway apparatus and along the other half the lighting apparatus is located. Current is supplied to this apparatus in part by six transformers, each rated at 10,000 to 375 volts, and 110 kw, and of the air-blast type. These six transformers are connected in two groups with two rotary converters, each rated at 300 kw, 40 cycles and 600 volts. Two other banks of transformers are made up of six units with a rating of

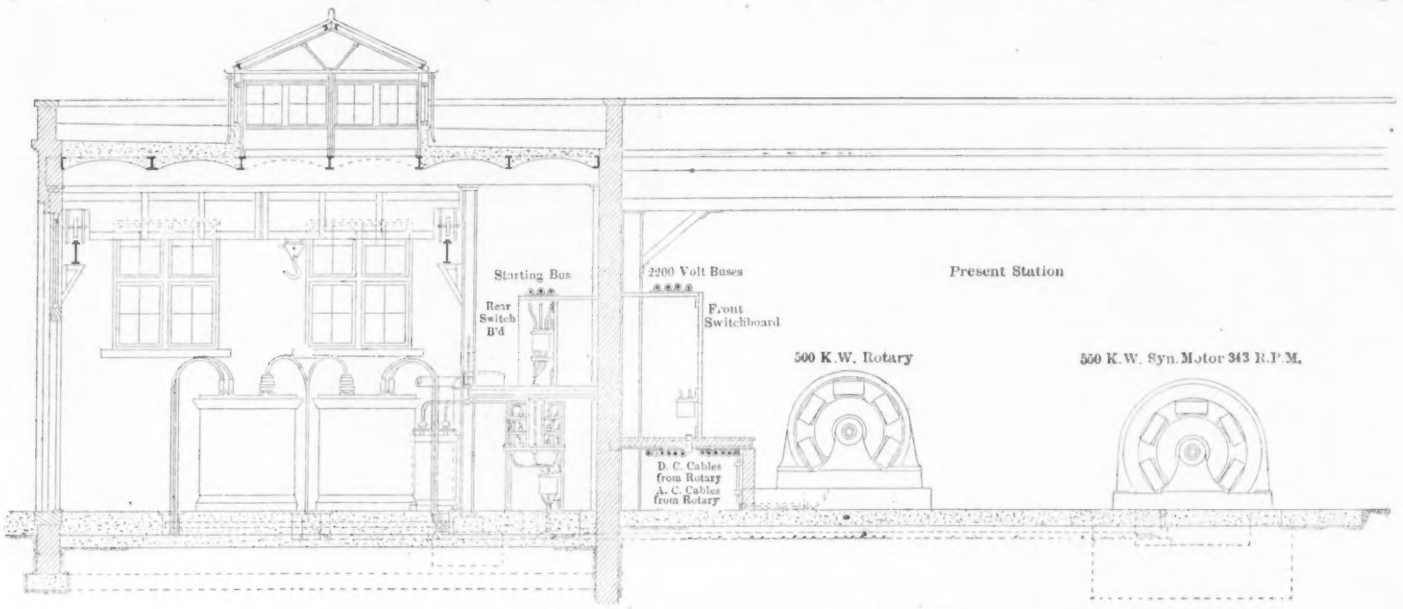



FIG. 8.—CROSS-SECTION THROUGH PRESENT STATION AND NEW EXTENSION, ALBANY.

10,000 to 375 volts and 220 kw each, and each of these banks feeds a 600-kw, 600-volt, six-phase, 40-cycle rotary converter. With each of the 300-kw rotary converters there is a 45-kilovolt-amp. reactive coil of the air-blast type, and with each 600-kw rotary there is a 90-kilovolt-amp. reactive coil of the same type. Space has also been provided for three more 220-kw transformers and one 600-kw rotary converter with its reactive coil. Each group of three transformers

is connected to the 10,000 bus-bars through a type H General Electric oil switch, electrically operated by current from a battery of 55 type E storage cells made by the Electric Storage Battery Company. The panels that carry the controlling switches for all the apparatus at the sub-station are of black enameled slate, and the maximum pressure to which they are exposed is 15 volts. Of these panels three carry instruments for three incoming lines of 10,000 volts and 4,000-kw capacity each. On each of these three panels there is one horizontal edgewise ammeter, one voltmeter of the same type, one double-pole

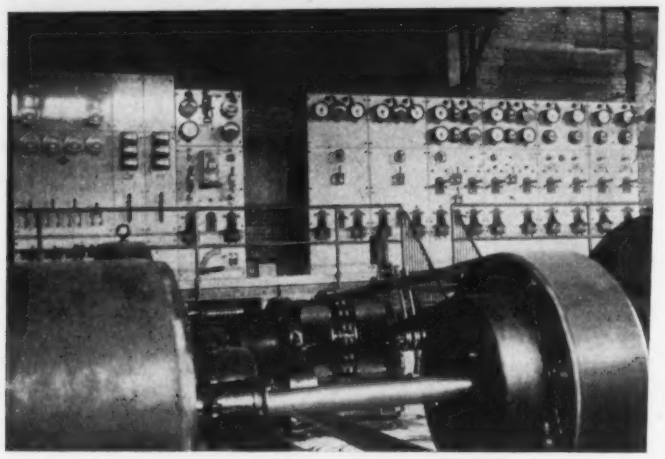


FIG. 9.—SWITCHBOARD, ALBANY.

overload relay that indicates by lamps whether the oil switches are open or closed, one controlling switch for the type H oil switch, and a current and potential transformer and static dischargers. The two panels for outgoing lines are of 10,000 volts and 1,500-kw capacity each, and equipped like the incoming panels with the addition of polyphase induction recording wattmeters. For each rotary converter the panel includes a recording wattmeter, power factor indicator and overload relay, besides volt and amperemeters, controlling

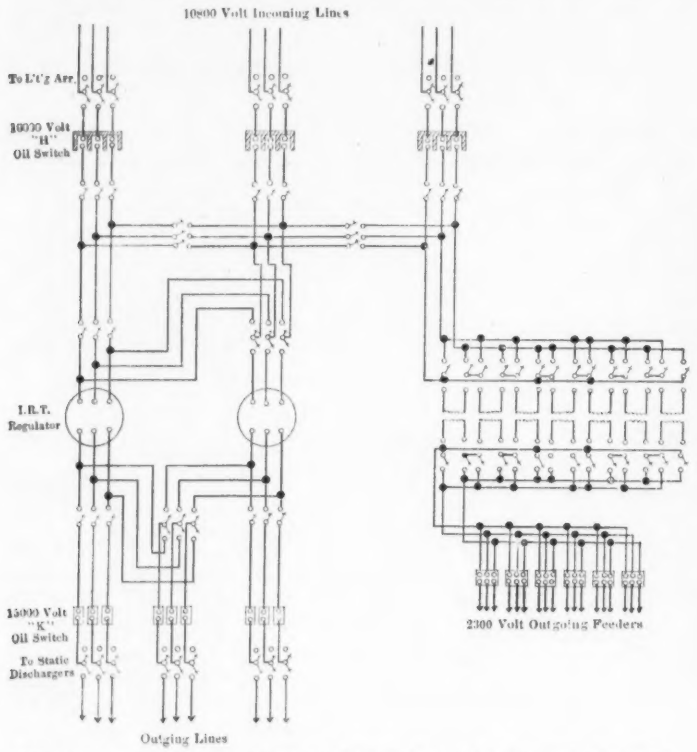



FIG. 10.—DIAGRAM OF MAIN CONNECTIONS, ALBANY SUB-STATION.

switches for the type H oil switch, indicating lamps and secondary transformers. Lamps in the sub-station may be operated from either the regular lighting circuits, the railway circuit or from the storage battery above mentioned.

Two 75-kw motor-driven exciters are already in use at the sub-station, and space has been provided for a third set when required. The lighting equipment at this sub-station includes synchronous motor-generators and constant-current transformers. Each of three of the motor generators is made up of a 550-kw, 10,000-volt, 40-cycle, three-phase motor, and a 500-kw, 2,300-volt, 60-cycle, three-phase generator. Space for a fourth motor generator of this capacity is also provided. Each of the other three motor-generators is of 250-kw output capacity, and converts the 10,000-volt, 40-cycle, three-phase current to 2,300 volts and 60 cycles. Each synchronous motor of these motor-generators is connected with the 10,000-volt, three-phase bus-bars through one of the electrically-operated type H oil switches. Series arc lighting is provided for by eight constant-current transformers of 4,000 volts and 6.6-amp. capacity each. These

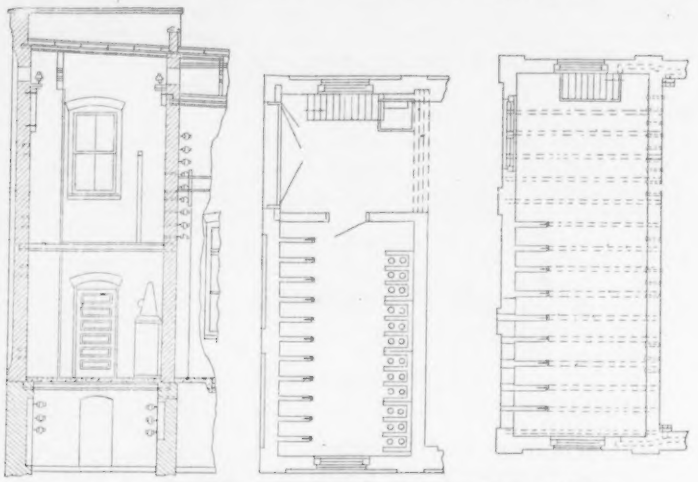


FIG. 11.—SECTION AND PLANS, ALBANY SUB-STATION.

transformers are supplied with 2,300-volt, 60-cycle current from the motor-generators. Current of 40 cycles was tried for arc lighting from the old sub-station, but its use has been abandoned. As may be seen from this list of equipment, the sub-station sends out only two sorts of current for the general supply of light and power; that is, current of 60 cycles at 2,300 volts and constant-current of 6.6 amp. and the same number of cycles as the other. Two automatic regulators are provided at the sub-station for the two most important 2,300-volt circuits that leave it for lighting service, and hand regulators are connected in the other 2,300-volt lighting feeders.

Between the Dock Street sub-station and the main business parts of Schenectady the lighting and power circuits are composed of underground cables in Camp tile ducts. Feeder cables for the 2,300-volt circuits have three conductors each, and these conductors in

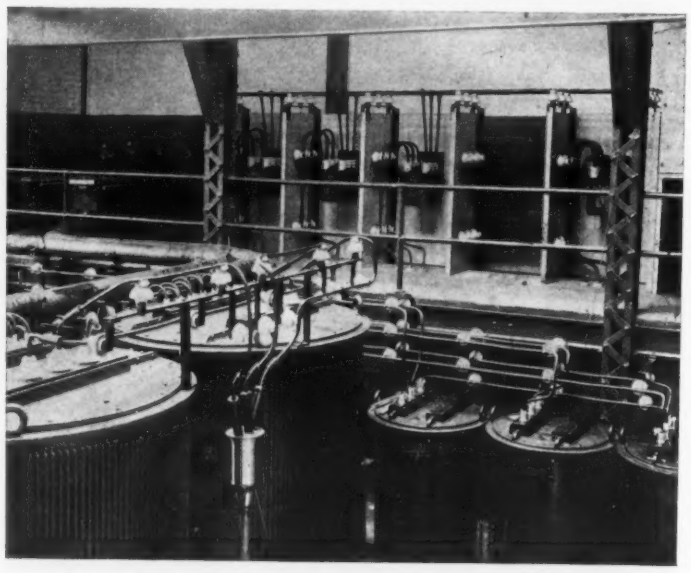


FIG. 12.—TRANSFORMERS, ALBANY.

most cases are each of 500,000 cm. cross-section. For the constant-current arc circuits single-conductor cables are used. The general distribution system for light and power at constant pressure includes 2,300-volt, 60-cycle, single-phase primary mains, subway transformers in manholes and three-wire secondary mains at about 250 volts. In the outlying parts of the city the 2,300-volt underground feeder cables connect with overhead feeders, and these feeders supply banked transformers and secondary three-wire mains as far as is practicable. Separate transformers for single customers are used only in isolated

locations. The connected load of the Schenectady electrical supply system includes constant, alternating-current arc lamps, constant-pressure alternating arc lamps, incandescent lamps on constant-pressure circuits, and induction motors at 550 or lower voltages. All arc lamps are of the enclosed type. Substantially all of the commercial service is supplied through meters of which there are 5,306 in use with 5,309 customers. The number of arc lamps used for street lighting is 440 of the 6.6-amp. type on series circuits, with an estimated equivalent capacity of 4,400 incandescent lamps of 16 cp each. Commercial arc lamps on constant-pressure circuits number 519, with individual ratings of 4 to 25 amp., there being 10 of the largest size, and the number rated at 6 amp. each is 482. Estimated on the basis of 16-cp incandescent lamps, the equivalent capacity of these commercial arcs is 10,030 in number. Commercial incandescent lamps number 84,572, and their equivalent capacity in lamps of 16 cp is 79,-

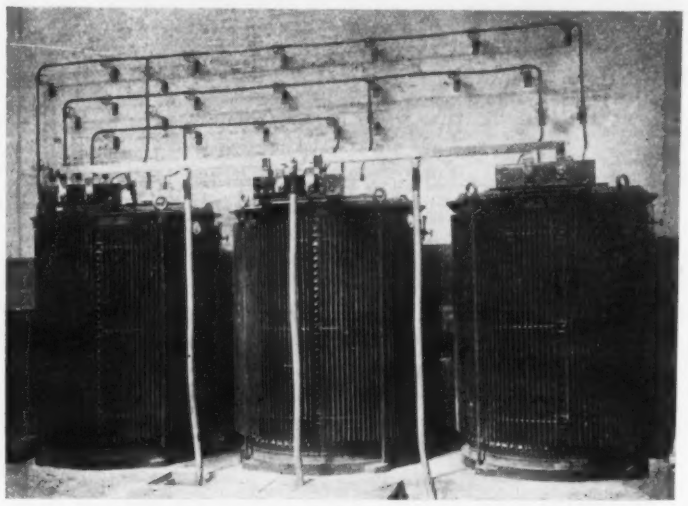


FIG. 13.—A GROUP OF TRANSFORMERS, ALBANY.

180. In candle-power these incandescent lamps range from 4 to 100, and the number of 10-cp lamps is 16,820, of 16-cp 63,769, and of 100-cp 6.

All motors are of the induction type, and their total number is 173, with a combined rating of 671 hp, and an equivalent capacity of 11,140 incandescent lamps of 16 cp each. These motors range from 1/16 to 50-hp capacity, and there are five of the 20-hp, five of the 30-hp, and two of the 50-hp size. The equivalent rating of all the lamps and motors above named is 100,350 incandescent lamps of 16 candle-power.

Besides the above connected load the Schenectady Railway Company has secured a twenty-year contract, subject to confirmation at the end of each three-year period, to pump all of the public water supply for the city. This water is pumped into standpipes under a head of 110 pounds and with a suction of 6 pounds. For the work of pumping there have been provided two vertical turbine centrifugal pumps with a daily capacity of 12,000,000 gallons. To each of these pumps there is direct-connected an 800-hp, 40-cycle, 550-volt induction motor. Each motor is supplied with current from the 2,300-volt, 40-cycle, three-phase line through three transformers rated at 250 kw each. Two pole lines and circuits extend from the Dock Street sub-station to the pumping station, and the supply of power is assured by the fact that not only the water-driven stations at Spier Falls and Mechanicville, but also the steam plants at the General Electric Works can be drawn on. The entire electrical equipment at the Dock Street sub-station, and most of the lamps and motors on the supply system are of General Electric make. The facts as to this notable application of water power have been obtained through the kindness of Mr. A. L. Rohrer, of the General Electric Company, and Mr. F. G. Sykes, of the Schenectady Railway Company. The Schenectady system is shown in Figs. 1 to 6. The Albany system is illustrated in Figs. 7 to 13.

## New Rapid Transit Tunnel for New York.

Governor Odell has signed the two New York City rapid transit bills passed by the New York Legislature. The bills were introduced at the request of the Rapid Transit Commission, which is now enabled to proceed with the arrangements for the construction of another independent rapid transit tunnel up and down Manhattan Island.

## Lamme Single-Phase Railway System.

Two patents were issued May 3 to Mr. Benjamin G. Lamme on applications filed December 26, 1901, covering his single-phase alternating-current electric railway system, one being a so-called "system" and the other a "method" patent. The specifications cover in an abridged form the specifications of the English patent, which were printed in full in our issue of February 13 of this year. As against the four claims in the English patent, the American "system" patent contains seventeen claims and the American "method" patent eight claims. The illustrations are the same as those in the English patent, with one exception in the "system" patent, which illustrates a method of voltage regulation.

Referring to Fig. 1, the car transformer has two secondary circuits, one of which is closed on itself and the active length made variable by means of a switching device. The variable voltage in this circuit may be impressed upon the motor circuit through the series transformer diagrammatically indicated. By reversing the connections this variable impressed voltage may be employed either to subtract from or add to the voltage of the motor circuit through all of its varying values, thereby providing the necessary variation of

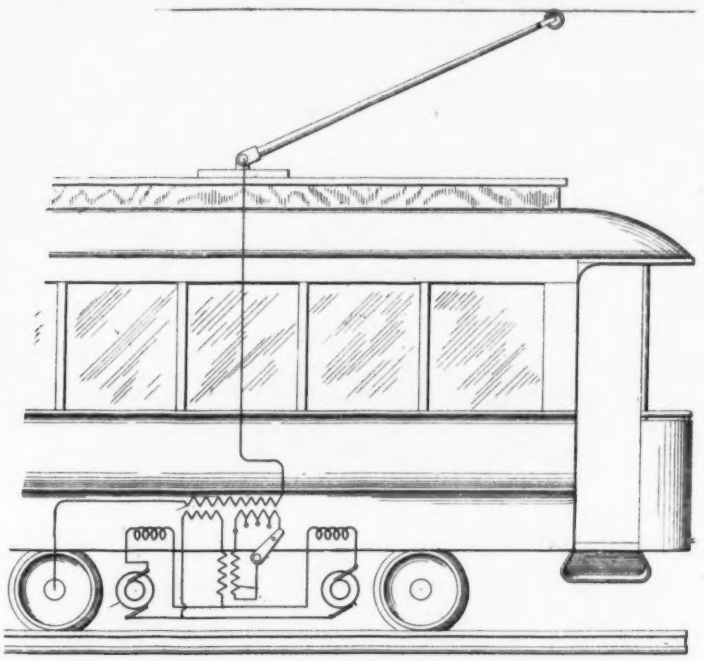


FIG. 1.—DIAGRAM OF CAR TRANSFORMER.

motor speed from zero to the desired maximum. It is stated that with this combined arrangement the motors may be designed for such voltage and such current as are best adapted for their operation, and the controller designed for some other voltage and current best adapted for its operation. Instead of varying the active length of a portion of the main transformer winding, the magnetic relations of the primaries and secondaries may be varied by adjusting one of the parts with reference to the other in a well-known manner; or such adjustment may be combined with means for varying the active length of a portion of a transformer winding.

A third patent issued on the same date to Mr. Lamme, on an application filed October 31, 1902, relates to details of his single-phase alternating-current motor. The object of the invention is stated in the patent to be to provide a single-phase motor with high-resistance conductors between the armature coils and the commutator bars, which shall be advantageously disposed with reference to the other parts of the motor.

In motors of this type the armature winding is of the closed-coil, parallel-circuit type and is closed upon itself, and as the magnetic field of the motor is alternating, any short-circuited turn through which the magnetic flux from a field pole passes will have a secondary current set up in it. By the well-known laws of the transformer, the ampere-turns in such short-circuited secondary will approximate the ampere-turns in the primary winding, which is in this case the field magnet winding. By reason of the character of the armature winding certain of its coils are short-circuited through the brushes when the adjacent commutator bars, to which the ends of the coils are connected, are bridged thereby, and when the brushes

are located in neutral positions or without lead the short-circuited turns surround the paths of the magnetic flux and are, therefore, good secondary circuits in which under ordinary conditions relatively large secondary currents are set up by induction. This is the principal cause of the excessive sparking in series motors of ordinary construction when it is attempted to operate them upon an alternating-current circuit.

In order to obviate destructive sparking, the current in the short-circuited turns of the armature coils should be limited to an amount materially less than what would normally flow. This may be effected by inserting a definite amount of resistance in each of the leads between the closed winding and the commutator bars. The working currents in the armature winding will not pass through these resistances except at the bars in contact with the brushes, because the armature winding is closed upon itself inside or beyond the resistance leads. Consequently, the loss in the winding due to the introduction of the resistance may be relatively small, and when the armature is rotating this loss is distributed successively through all the resistances, thus making the average loss per resistance lead very small. Various ways of introducing such a resistance may be employed; but to provide the desired amount of resistance and at the same time so dispose it that it will be securely supported under the comparatively rapid rotation of the armature is a somewhat difficult problem.

In motors of large power employed for operating railway vehicles the space allowable for the motors is extremely restricted, and hence it is a matter of material importance to so dispose the several elements of the motor as to secure the desired ventilation and general efficiency without occupying more than the allowable amount

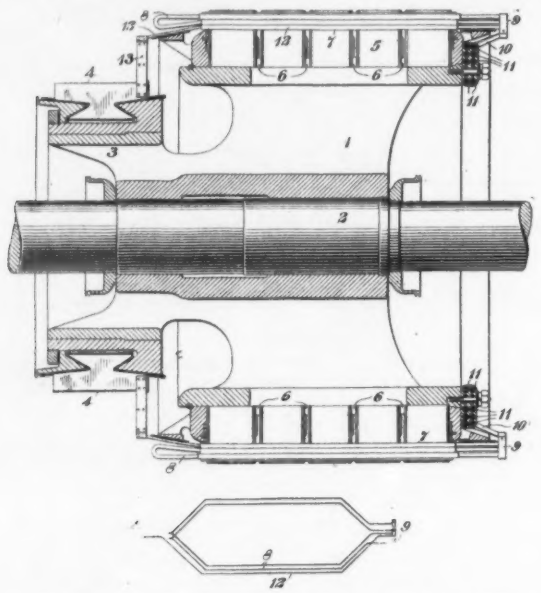


FIG. 2.—SECTION OF ARMATURE AND COMMUTATOR.

of space. Fig. 2 shows a longitudinal section through an armature and commutator of such a section, and a diagram of one of the armature coils.

The skeleton frame or spider, 1, of the armature is mounted upon and keyed to the shaft, 2, in the usual manner and is provided with an extension, 3, on which is mounted the commutator, 4. The laminated core, 5, is mounted and suitably fastened upon the frame or spider, 1, and is provided with ventilating ducts, 6, and with slots, 7, in which are mounted the coils, 8, these coils being connected at the end remote from the commutator by means of suitable connectors, 9, so as to form a closed parallel circuit winding, the winding being also joined by means of conductors, 10, to balancing rings, 11, in order to properly balance the magnetic circuit.

Each coil, 8, is connected to its appropriate commutator bar by means of a conductor, 12, of relatively high resistance and a connector, 13, one end of which is fastened to the corresponding commutator bar and the other end of which is fastened to the corresponding end of the resistance conductor, 12. This conductor, 12, may be formed of German silver or other suitable high-resistance material and is located in the bottom of the slot, 7, it being provided with a suitable insulating sheath in the same manner as are the corresponding portions of the coils, 8. There is, obviously, one of these resistance conductors, 12, in each slot, and since it is located in the bottom of the slot it is advantageously disposed both as regards the security of its position and also because it does not interfere in any way with the proper disposition of the other parts of the machine.

The claims cover the combination with a commutator of an armature core provided with slots, a parallel closed circuit winding and high-resistance leads connecting the winding with the commutator bars, the coils and leads being located in the slots and connected together at the end of the armature remote from the commutator.

On the same date a patent was issued to Mr. Charles F. Scott on a system of alternating-current distribution particularly adapted to

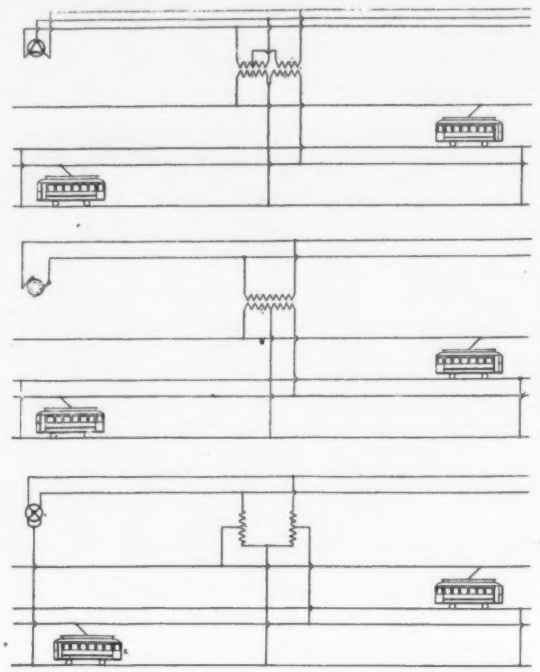


FIG. 3.—DIAGRAMS OF DISTRIBUTION SYSTEMS.

systems employed for operating single-phase alternating-current motors, the armature and field magnets of which are in series relation. The object of the invention is stated to be to provide a system of distribution and transformation which shall insure economy in the use of electrical energy by the use of a single-phase transmission system for the operation of electric vehicles upon two parallel tracks. In the accompanying illustration, Fig. 3, the upper diagram refers to a three-phase transmission circuit, a double-track railway and transformers for supplying single-phase currents to the motors on their respective tracks. The middle portion is a corresponding diagram of a single-phase transmission system, and the lower diagram that of a two-phase, three-wire transmission system.

In the first-mentioned method three-phase currents are transformed to two-phase currents, one side of the two-phase circuit being connected with the track. It is stated that by this arrangement a saving in conductors for the transmission circuit is effected by employing the three-phase system, and that a further saving is effected by using the rails of the two roads as a common return for both circuits. In the single-phase arrangement the line voltage is transmitted at double the voltage of the trolley circuit, the rails being connected to the middle point of the secondary of the line transformer. The third method relates to a two-phase system employed with a ground return. It is stated that with this system there are the advantages of a polyphase transmission system and a saving in conductors by the use of the rails as return circuits for both phases of the high-voltage circuits and also for the two trolley circuits.

## Western Union and Erie.

It was reported last week that the Postal Telegraph-Cable Company would displace the Western Union Telegraph Company's service along the line of the Erie Railroad. It was also reported that a like change would take place about July 1 on the Pennsylvania lines west of Pittsburg. As to the former report both President Underwood, of the Erie, and President Clowry, of the Western Union, deny any knowledge whatever.

## Recent Electrochemical Developments.

ELECTROLYTIC PROCESSES.

The consumption of tin has increased enormously in recent years, notably on account of the very large amounts of tin used for tinned iron for canning. The production of tin from the ores has also increased, but not to the same degree. Under these circumstances, the electrolytic winning of tin from tinned iron scraps or from the cans after the preserves have been eaten has become a well-paying business. It is estimated that in Germany alone at present about 35,000 tons of tin scraps are treated per year electrolytically, from which 2 to 2.5 per cent., i. e., about 800 tons of tin are won, amounting to about $500,000. These processes are used on a large scale, notably in two German plants, but have been introduced later into Holland, and also recently to this country. The processes used are kept secret, especially the electrolyte, although it is generally understood that the commercially successful companies use an alkaline electrolyte.

A patent granted on April 26 to Mr. E. Quintaine, of Argenteuil, France, relates to a new process of this kind, the feature of which is the electrolyte which consists of a solution of acid nitrate of tin, to which a certain quantity of sulphate of ammonia is added in order to neutralize the bath. The inventor prepares a bath of a solution of acid nitrate of tin, to which is added gradually a certain amount of sulphate of ammonia and a tin chloride. This gradual addition to the solution is continued until precipitation ceases.

A patent granted on May 8 to Mr. H. Spence, of Manchester, England, refers to the production of a "new titanous sodium-sulphate compound" for use as a reducing agent in various manufacturing processes, in the discharge of coloring matters from textile fabrics, etc. The compound is produced by means of electrolytic reduction of titanium sulphate in the presence of sulphuric acid, with an addition of sodium-sulphate, and by means of evaporating the solution afterwards.

The importance of thorough stirring of the electrolyte for certain electrolytic processes is well known. Some means of stirring becomes necessary whenever the object to be obtained by electrolysis requires the solution to be kept as much as possible in its original condition. For instance, if a metal is to be deposited from a solution of one of its salts, the tendency of electrolysis is to render the solution near the cathode poor in the ions of the metal to be deposited. This results then in a new reaction which is mostly generation of hydrogen, and represents a waste of energy. Various apparatus have been suggested by which it is possible to obtain a thorough agitation of the electrolyte. Two patents granted on April 26 to Mr. G. E. Dunton, of New York City, refer to mechanical details of such devices. The author makes use of pumps and pipes provided with nozzles.

A patent granted on April 26 to Mr. G. K. Jenney, of New York City, refers to mechanical details of an apparatus for electroplating sound records. The inventor describes a case or holder by which the sound record discs may be supported through peripheral contact only and the record surface thereby fully exposed to the electrolytic action and protected at the same time from accidental blows or mutilation.

ELECTRIC DISCHARGES THROUGH AIR.

A further contribution to this subject which has been investigated by various experimenters in recent years—mainly with two objects in view, viz.: the fixation of nitrogen and the production of ozone—is given in two patents granted to Mr. J. N. Alsop, of Owensboro, Ky., on May 3. He does not state exactly the chemical compound which he wants to get, but says that the air after treatment contains nitrogen peroxide and traces of ozone and "is in a state of ionization." He states, however, explicitly for which purpose he wants to use his modified air. The object is to whiten and purify cereals and otherwise improve their quality. For instance, flour is very noticeably bleached, the dough then formed is drier and more elastic and sections of the loaves of bread made from such dough have a fine white color.

In his apparatus he uses essentially two sets of electrodes which in turn are separated to form an arc. When the arc between the first set of electrodes is formed by separating these electrodes, the electrodes of the second set are being brought together and when they make contact a short-circuit is produced and the arc of the first set is extinguished. The second set is then separated, etc.

STORAGE BATTERY INVENTION.

The well-known process of Mr. A. G. Betts for electrolytic lead refining has led the same inventor to a storage battery of the following construction described in two patents, granted on May 3. He places two graphite electrodes in a strong solution of lead fluosilicate containing some free acid or a somewhat acid solution of fluosilicates of lead, and another metal, such as copper, capable of being deposited by electrolysis practically free from lead from such a solution. On passing an electric current of moderate strength through the cell, peroxide of lead is deposited on the anode in a dense, adherent and well conducting form, while metallic lead or the other metal (copper) is deposited on the cathode. Free fluosilicic acid remains in solution. This represents the charging of the cell. During discharge the reactions are reversed.

A patent granted on May 3 to Mr. J. T. Niblett, of Greenwich, England, refers to the type of battery in which the cell is filled with granules or pellets forming the active elements. As active material the inventor uses a mixture of granulated lead or granules of lead oxide incorporated with kieselguhr.

A patent granted to Mr. V. G. Apfel, of Dayton, Ohio, refers to the following construction of a storage battery. The whole case is divided into two compartments, the inside surface of each compartment being electrochemically active. Each compartment contains a series of liquid-tight conducting cases, one within the other and insulated one from the other. Their respective interior and exterior surfaces are electrochemically active. Within the inner case of each compartment a central element is provided which constitutes one electrode.

A patent granted to Mr. W. J. Redmond, of Cleveland, Ohio, refers to the construction of a storage battery plate in which the surface is provided with a great many hair-like projections for holding the active material.

## New Telephone Patents.

NEW RECEIVERS.

A three-pole receiver is undoubtedly unusual, but such is one recently patented by Mr. E. H. Strauss, of Chicago. The design of this may be best understood by a reference to Fig. 1 wherein, in the upper part of the figure, is shown a section of it. As will be noted, a metal cup supporting both diaphragm and magnetic system, is clamped within the casing by the cap piece. The single oblong coil surrounds

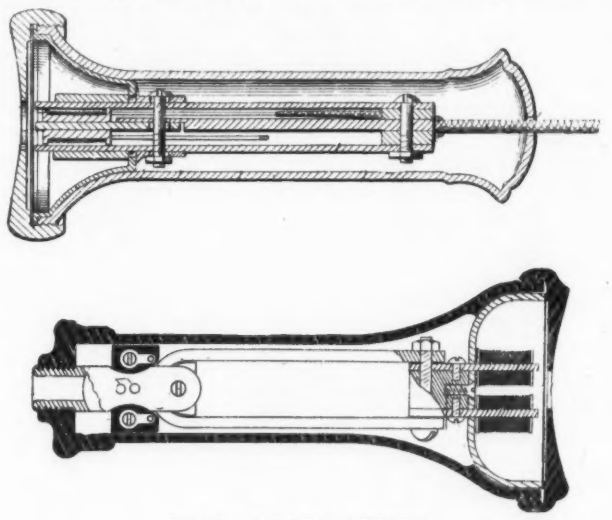


FIG. 1.—STRAUSS RECEIVER.

a flat rectangular pole piece, which is an extension of a central bar magnet. At the other extremity of this bar magnet are iron spacing pieces, outside of which are bolted two other bar magnets in such a manner that each forms a return pole piece extending nearly to the diaphragm. This magnetic system is adjustably supported from the metal cup, the clamping bolt securing it thereto running in slots in the base of the cup. A still further means of adjustment is obtained, by using this same clamping bolt to secure the pole piece to the central magnet and providing this pole piece with a slot. This enables an adjustment of the air-gap of the central leg of the magnet entirely independent of that of the side poles.

Still another receiver having the magnetic system supported from a metallic cup is that patented by J. S. Gemmill, of Cleveland, Ohio. A sectional view of this receiver is shown in the lower part of Fig. 1. The most novel feature is undoubtedly a clevis screwed into the tail of the receiver casing and spanning the closed end of the U magnet.

This serves to take up side strains and at the same time to form a guide for the receiver cords and a mounting for the hard rubber terminal block.

TRANSMITTER.

Mr. Gemmill has also patented a transmitter of a design to prevent moisture penetrating the granular button. This result is accomplished by supporting the front electrode upon a disc clamped between two annuli of sponge rubber. One of these is the insulating medium within the metallic granule box, and the front electrode supporting disc is held tightly against it. This pressure has, however, little effect upon the susceptibility of the electrode to motion, as it is caused by pressure exerted by an exactly similar ring, the net result being a supporting of the electrode between two balanced springs.

AN EXTENSION STATION WIRING.

Another circuit patent is that of Messrs. Charles E. Scribner and J. L. McQuarrie, of Chicago, which describes a method of so wiring a main and extension instrument upon a single line that these may be used independently of the central office and yet may receive their entire current supply therefrom. The circuit hinges upon the removal of the line relay from the ungrounded side of the line as usually arranged in the Bell Company's switchboards and the placing of it in the grounded side of the line. Thus, the battery may be fed

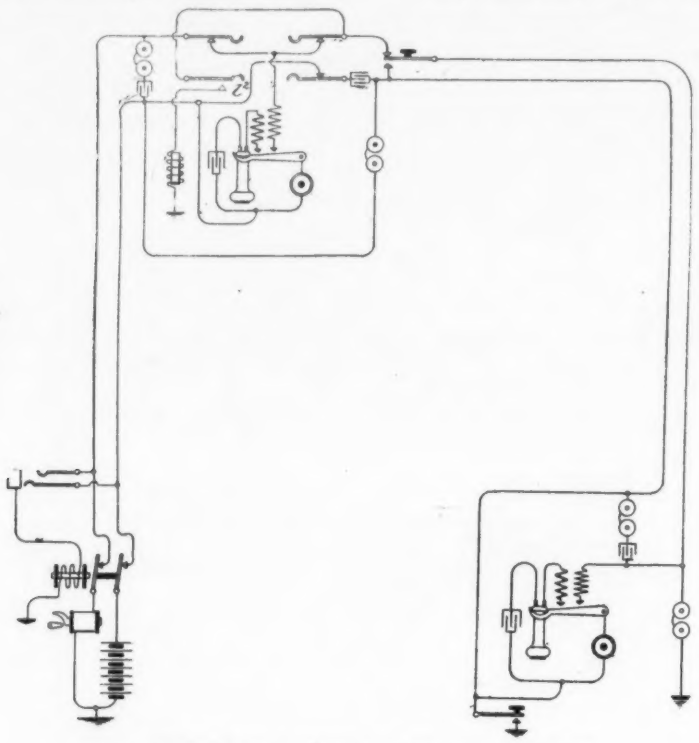


FIG. 2.—SCRIBNER & M'QUARRIE TELEPHONE SYSTEM.

out from the central office over one side of the line and return through the ground, without effecting the display of a line signal. Signalling between the main and extension stations is by single-stroke bells working by direct current under the control of contact keys located at the two stations. Provision is made that either station may call or be called by the central office; that either may call the other without signalling the central office; that that the main station may cut the extension from the circuit at will. With this explanation, the operation of the circuit, shown in Fig. 2, may be readily traced by those familiar with this line of work and to whom alone it is of interest. The Western Electric Company has obtained the patent by assignment.

TWO-WIRE SWITCHBOARD CIRCUIT.

A patent for a two-wire common battery switchboard circuit has just been issued to Mr. W. W. Dean, which differs considerably from the two-wire circuits now used by the Kellogg Company, to whom it has been assigned. In this system a line relay and a cut-off relay are provided, the cut-off relay leaving the talking lines undisturbed, and instead cutting off the line signal apparatus. In such an arrangement, but two wires being available, the cut-off relay must be included in series with the line relay, and to warrant its remaining unoperated during the display of the line signal, its resistance must be made low in comparison with that of the line signal. On the other hand, as during a conversation, the cut-off relay is virtually bridged across the line, a high resistance, therefore, is desirable. To meet both requirements, Mr. Dean has double-wound his relay, the windings being of unequal resistance and in series. The higher winding is normally shunted out by the back contacts of the relay. Now, when a calling signal is sent, the small line relay current passes without effect through the low-resistance cut-off relay coil. When the operator responds a large current traverses the cut-off relay until the relay can respond. Then the line relay being cut off, the shunt on the high resistance part of the cut-off relay is removed, and the relay now of high resistance remains in the operated condition until disconnection is made.

## Copyright in Telephone List.

The Rocky Mountain Bell Telephone Company has issued a letter to the public of Salt Lake City asserting copyright in its telephone list. The notice is as follows:

Our attention has been called to a letter sent to our subscribers by the Utah Independent Telephone Company, signed by H. B. Brown, Manager Contract Department, offering to retain in the new company the same numbers now held in ours. For several years we have endeavored to convince the people of Salt Lake that two telephones would be a burden upon them, and that the Rocky Mountain Bell Telephone Company is able to give them all the service they need, and more than can be furnished by any other company for years to come. The letter referred to shows that the Independent Company expects you to subscribe to two telephones, with an added cost and inconvenience, which we claim is unnecessary. With our over 5,500 subscribers in Salt Lake, and our long lines connecting every city, town and village in the inter-mountain region, we feel justified in saying that we can give you a service that no other company can give.

This letter is called forth by a constant demand from our patrons to know what they should do. This is our answer: We have tried to serve you in the past and feel that we can do better in the future. Two telephones are a nuisance and will cost you more money than one; our advice is to wait and see whether the "pig in the poke" is worth buying. We most decidedly object to the use of our telephone numbers by the Utah Independent Telephone Company, or by any other company. Our telephone numbers are all copyrighted, and the property of this company, and will be protected.

## CURRENT NEWS AND NOTES.

*VOLUNTEER RUSSIAN TELEGRAPHERS.*—The Czar of Russia has accepted the offer of the senior class of the Electro-Technical School at Odessa to serve as volunteer telegraphers in Manchuria. These volunteers will have charge of the wires along the Manchurian line.

*INDEPENDENT TELEPHONES IN POST-OFFICES.*—Some weeks ago the Postmaster-General ordered the removal from post-offices of all telephones that did not have long-distance connection with Washington. This cut out the independent service. The independent telephone interests protested against this action and sent representatives to Washington to secure a modification of the ruling. Their efforts, it seems, have been rewarded with success and a bill has passed through Congress providing for such an ample appropriation for telephone service that the independent companies will not be compelled to remove their instruments from post-offices. One of the principal claims for the independents has been that they have brought the people in touch with the public utilities.

*THE EDISON MEDAL.*—President Bion J. Arnold, of the American Institute of Electrical Engineers, has addressed to the educational institutions of the United States and Canada a statement with regard to the Edison Medal founded this year and calling their attention to the fact that it is open for competition by students for the best thesis or record of research on theoretical or applied electricity and magnetism. Mr. Arnold announces that the medal committee of the Institute is being formed and requests the authorities of institutions qualified and desirous to compete to send in their names to the medal committee, at 95 Liberty Street, New York City, on or before June 1, when further information will be given. It is hoped and expected that there will be a large competition from among the graduating students in electricity.

*EVANESCENT RADIUM.*—According to statements made by Prof. Sir William Ramsay, as reported in a recent special newspaper dispatch, there will be no more radium 1,150 years from now. It will all have disintegrated and vanished in the meantime. Radium, Sir Ramsay is reported to have said, instead of being a primeval substance which has been slowly disintegrating since the world began, is merely a temporary phase of matter, an unstable resting point in a series of transmutations, of which nobody knows the beginning, or end, or meaning. The rate of disintegration does not depend upon the quantity existent. It would all vanish, whether it measured a cubic inch or a cubic mile, forming in the process other substances, the only one at present known being helium. It is obvious, therefore, that radium must now be in the course of production. If it had been an original deposit it would have disappeared long ago. It was the merest speculation to discuss how it was produced. Nobody knew, but possibly it came from uranium.

*TELEPHONES IN A CONVENTION.*—It was decided recently at the St. Louis meeting of the Committee on Arrangements for the convention of the Democratic National Committee to introduce an innovation in the form of telephonic communications between the platform and each of the State delegations at the National Convention in July. The proposal to connect the chairman with all parts of the hall, in order that his attention may be secured promptly by the person first entitled to receive recognition, was accepted after a very brief discussion. In addition to being connected with the State, the chairman will be able to communicate by telephone with the officers of the convention at the doors or any other part of the hall. The importance of the innovation will be appreciated by all who have attended a national convention. Outside of the main hall, the telephone service will be extended to the lobbies, where many additional instruments will be installed, affording long-distance connections.

# LETTERS TO THE EDITORS.

## Reciprocating vs. Turbine Engines.

*To the Editors of Electrical World and Engineer:*

SIRS:—Referring to Mr. Seymour's communication in your issue of April 30, I have as much aversion to entering into anything of the nature of a controversy as Mr. Seymour, and would not ask you for space to reply to his communication were it not for some of his statements regarding the steam turbine, which I feel, if left unchallenged, would leave but a poor impression of the adaptability of the steam turbine for general power purposes. Mr. Seymour says:

"According to his figures (that is, mine), if the vacuum should fall to, say, 21 in. instead of 25 in., which, however, does not seem unreasonable, the capacity of the turbine would be cut down 30 per cent., with a corresponding increase in steam consumption, and under such conditions, with a drop in the steam pressure of 10 per cent., the turbine would not pull its rated load, with by-pass full open."

This, in the face of my statement that all Westinghouse-Parsons turbines are capable of carrying full load without any vacuum at all. The 10 per cent. drop in steam pressure would affect the capacity to about a similar extent, but the falling off of economy would be only 3 per cent.

The figures Mr. Seymour referred to were a mere statement on my part, that for each inch of vacuum above 25 in. the economy of the turbine was affected 3 per cent. to 4 per cent.

With reference to an attendant having to be on the spot to open a hand-operated by-pass arrangement for carrying overloads, would say that where the exigencies of the station demand such a thing, this valve is made automatic and is operated by the governor, in which case the turbine is capable of meeting the most exacting demands of fluctuating loads. I fail to see how this feature is any more "a drag upon both boiler and condenser" than in the case of a reciprocating engine carrying overload by means of an extended cut-off.

At the conclusion of Mr. Seymour's letter, he makes some remarks from which inference might be drawn that the economy of a turbine is likely to fall off with age. Experience of five years in this country shows absolutely no deterioration of the working parts, on which condition the economy depends. European experience has been similar in this respect, tests having demonstrated that there has been no falling off in economy.

PITTSBURG, PA. FRANCIS HODGKINSON.

## Electric Conductors in Pipe Galleries.

*To the Editors of Electrical World and Engineer:*

SIRS:—The report of the Plans Committee of the Rapid Transit Commission having again brought the question of pipe galleries prominently to the front, I ask permission to comment briefly on the editorial remarks in your issue of April 16, suggested by the fire in the subway at Broadway and Fulton Street, which temporarily threw out of service so many telephone and telegraph circuits. Your editorial conclusion appears to be that this accident, instead of furnishing an argument for pipe galleries, supplies one against them. Obviously, if the subway had not been built the wires would not have been disturbed, and what happened would not have happened. It may also be true, as you say, that "in most of the pipe gallery schemes which have been discussed from time to time, the plan has been broadly that of carrying the cables in masses through an open tunnel, thus exposing them throughout their entire length to the danger of just such an accident as that which has occurred, and which will inevitably occur again unless greater care is taken."

The prospect of following foreign practice which, in several cities, has given excellent results, does not alarm me as much as it probably would if I had been at less pains to learn what results have followed the crude methods of pipe gallery design which were originally proposed for New York. Permit me to quote further from your editorial comment as follows: "At first glance, the pipe gallery idea has many recommendations, particularly in the ready accessibility of the various services and the facility with which new services can be installed, thus, for example, rendering new competition feasible, which to-day does not appear easy to effect. On the other hand, it does seem as though in working out a pipe gallery scheme, the first consideration should be given to dividing up the services rather than bunching them, so that as in a sectional water tube boiler, the danger would be lessened rather than increased." In the pipe galleries designed for lower Broadway by direction of President Cantor, of Manhattan, at least average intelligence was displayed in planning to accomplish exactly what you deem necessary. Not only did every conductor have its own vitreous conduit encased in cement, but the systems were so divided that the light and power wires were wholly separated from the signal wires, and access to them was had through separate manholes. There was absolutely no connection between the ducts for electric conductors of either class and the chambers containing gas or water pipes. In these respects the system was beyond intelligent criticism, unless based on the ground that it embodied refinements which nothing in foreign experience shown to be necessary for the protection of the public or of private interests. To the engineer responsible for this design it seemed wise to err on the side of safety, and in submitting his plans to President Cantor to say: "Foreign experience in safely grouping high-tension and low-tension electrical conductors, gas mains and water mains in common chambers would seem to indicate that in designing the pipe galleries for lower Broadway excessive regard for safety has been shown in giving the electrical systems ducts in which not only are the high and low-tension wires completely separated, but are wholly removed from even proximity to gas mains. This seemed desirable, if not necessary, in the present instance, but I am of the opinion that in future work of like character the foreign practice may be more closely followed with economy and safety."

The foreign practice here referred to may be learned from the typical example of the pipe galleries built and building by the London County Council, under such of the thoroughfares of that city as are improved in a large way. A sectional drawing given me by Mr. Maurice Fitzmaurice, chief engineer of the County Council, shows the pipe gallery of the Victoria Embankment. It is an arched tunnel without divisions or partitions. Besides the water mains, it contains two 30-in. and one 36-in. gas mains, and a smaller gas pipe of probably four or six inches. The electric wires are disposed of by stringing them on racks dependent from the crown of the arch or on trough-like shelves against one of the side walls. Nothing cruder in design could be imagined, but the system works very well and gives no trouble. The water mains do not break or leak, and an

occasional low place where any water which gets on the floor of the gallery may run and be removed by the attendants in pails, is all that is found necessary. There is no gas leakage. Mr. Fitzmaurice, who visits the tunnels daily, assures me he has never noticed even the odor of gas. Permits are freely issued to plumbers to take torch lamps into the galleries, and to maintain naked flames for soldering purposes. I was myself invited to walk through the system with the chief engineer, and was told that I might smoke cigarettes the whole distance. The only persons not permitted to smoke in the galleries are the workmen, and the prohibition applies to them only during working hours.

I make no pretension to being a practical electrician, but the piling of cables one on another in troughs and on hangers suggested an inquiry as to what happened when crosses and short-circuits were established. I was told this rarely occurred, and that when it did nothing happened.

The fact of the matter in few words is that gas and water mains in tunnels do not leak, and that very crude appliances for keeping electrical conductors out of the way appear to serve their purpose very well. The dangers to be apprehended from pipe galleries are wholly imaginary; their advantages are almost incalculable, and without them New York can never hope to attain the character of a city of the first class.

NEW YORK CITY. JAMES C. BAYLES.

# DIGEST
## OF
## CURRENT ELECTRICAL LITERATURE.

### DYNAMOS, MOTORS AND TRANSFORMERS.

*Variable-Speed Motors.*—PUNGA.—An article on the design of direct-current motors for variable speed. The commutation is by far the most important factor and to get good commutation it is necessary that the number of armature turns per segment is kept small; that the number of lines of force entering the armature is large; and that the effective length of one turn as well as the free length are small. He gives some rules how to alter the design of a constant-speed motor, so as to obtain a good commutation for variable speeds. If the commutator cannot be decreased in diameter and the width of a segment cannot be decreased, then the most effective way to obtain the end in view is to increase the diameter of the armature, keeping the length constant. These deductions are valid only if mechanical difficulties do not prevent an increase of the armature diameter; if the corresponding speed motor has sparking for its limit of output, and if the number of turns per segment is larger than one. These provisions are discussed in detail. The general conclusions arrived at by the author are discussed for the example of a 7-hp, 125-volt semi-enclosed motor. Special devices for the prevention of sparking may be profitably used in variable-speed motors of a wide range. It is thought that a smooth-core motor fits admirably the requirements of the variable-speed motor, because the amount of copper employed is very small, causing only a slight increase of the air-gap. This motor should be designed with small diameter and large length of armature, since this affords the greatest advantage to the use of the smooth-core winding.—Lond. *Elec. Rev.*, April 22.

*Predetermining the Regulation of Alternators.*—TORDA-HEYMANN.—A paper illustrated by diagrams in which he develops a theoretical basis for the experimental predetermination of the regulation of alternators with reference to a former paper of Behrend (ELECTRICAL WORLD AND ENGINEER, 1903, Vol. XLII, p. 802). The regulation is defined as the drop in voltage which occurs when full load is put on the machine, excitation and speed remaining constant. His method is a graphical one and is based on the knowledge of the following three curves: First, the no-load saturation curve; second, the short-circuit curve, and third the apparent magnetic resistance curve. The abscissæ are in all cases the excitation in field ampere terms while the ordinates in the first curve represent the e.m.f. at the armature terminals, in the second curve the current in the short-circuit armature and in the third curve the apparent magnetic resistance of the alternator which is the ratio of field ampere terms to the e.m.f. of the generator. By means of these three characteristic curves the voltage drop on inductive load with power factor zero may most accurately be obtained by a simple geometrical construction. For other power factors, then, the regulation is easily determined by well-known methods. The method is described in detail and applied to various examples.—Lond. *Elec.*, April 22.

### LIGHTS AND LIGHTING.

*Gas Versus Electric Lighting.*—BOOTH.—An article on the advantages of modern gas lighting over electric light. The author says that for 100 years little or no improvement has been made in the methods of using gas. Nor was it looked upon as good policy to encourage systems of gas burning which made for economy. The standard of gas light was a paltry 16 cp from a flame burning at the rate of 5 cu. ft. of gas per hour. Now, the Welsbach burner using 3 to 8 cu. ft. of gas per hour, gives 18 candles per cu. ft. The present condition of gas lighting is such that the mantle bars the way to any further improvement, but with better mantles there can be better efficiency. "At present with one of the current systems a thousand feet of gas, at three shillings per thousand feet, will produce 36,000 to 40,000 candle-hours, or 1,000 to 1,100 candle-hours for one penny; that is to say, fully 20 hours of 50 cp for one penny. Users of electricity may compare their bills on the basis of three lamps of 16 cp each, run for 24 hours, and they will perceive how exceedingly extravagant a light is that from electricity." Gas lighting with modern methods is claimed to be at present far ahead of electricity in all respects, save convenience, and, under ordinary circumstances, health. Electricity lends itself to situations for which gas is out of question; but it is thought that for plain, straightforward lighting of rooms, workshops and public buildings, it is very doubtful whether electricity will hold first place in any sense of the term. It is pointed out that the "machinery of electric light" has become more complicated instead of simpler as time has moved on. "In coal consumption the incandescent electric light probably demands three times as much as modern gas lighting." It is thought that the hope for electric lighting at present lies in the direction of the arc light.—*Cassier's Mag.*, May.

### POWER.

*Steam Turbines.*—An illustrated description of the power plant of the Yale & Towne Manufacturing Company, of Stamford, Conn., which is the first factory plant which has adopted the steam turbine in comparatively large units. The Westinghouse-Parsons turbine units are of 400-kw capacity each, giving a total capacity of 1,072 electric hp. The equivalent, at the 85 per cent. over-all efficiency claimed for the units, of about 1,260 indicated hp. The space occupied by the turbines and the surface condenser is roughly one square foot for three indicated horse-power, but this does not include the space occupied by the circulating and hot-well pumps which are in the basement nor the dry vacuum pump which is in another part of the engine room. The turbines with their attached generators weigh 33,200 pounds apiece and are set upon concrete foundations which cost less than $400 for the two machines. The cost of installation erected and ready to run was about 65 per cent. of that of a unit of the same capacity and efficiency operated by a reciprocating engine. The first unit was guaranteed to produce an electric hp-hour on 16.5 pounds of steam at 155 pounds gauge pressure, superheated 40°, and with 28 in. of vacuum. With an over-all efficiency of 85 per cent., this would be 14.025 pounds of the superheated steam per indicated hp-hour. On test with the rated load, 150.92 pounds pressure, 19.66° of superheat and 26.95 in. vacuum, the turbine used 22.156 pounds per kw-hour, or 16.53 pounds per electric hp, or 14.05 per indicated hp. As neither the pressure, superheat nor vacuum were what they should have been, the guarantee is recorded as more than fulfilled. In the same issue a description with detailed drawings is given by Levin of a multiple impact steam turbine.—*Power*, May.

*Degree of Uniformity of Prime-Movers.*—BERKITZ.—A description of a new method for rendering visible the degree of uniformity of

the rotation of prime-movers during one revolution. A disc is loosely connected to the machine axle, but is made to revolve with uniform speed. The movements of the machine in relation to the uniform rotation of this disc are used for displacing the position of a mirror which also revolves. This mirror reflects the rays of a stationary series of light upon a surface, so that curves are described on this surface. The form and area of these curves depend upon the degree of uniformity of speed. From the curves it can, therefore, be determined whether the machine runs with the required degree of uniformity of rotation. A practical method of carrying out this principle is described and illustrated.—*Zeit. f. Elek.* (Vienna), April 17.

*Electric Cableway.*—An illustrated description of the cableway which has been installed for carrying 4,000 tons of railway construction plant over the Zambesi River in Africa. A special arrangement of steel towers for the cable has been adopted, with a special self-contained electric conveyor, which only requires a copper trolley wire to convey the current to it from the generating station on the bank. The conveyor is suspended on two traveler wheels running on the rope. On a frame which hangs down from the wheels are carried an electric motor, a chair for the driver, and two drums, which latter are actuated by the motor on which the hoisting ropes are wound. The conveyor is capable of lifting and carrying a maximum load of 10 tons, and it is estimated that no less than 800 tons of material can be transported across the river in one day.—Lond. *Eng'ing*, April 22.

REFERENCES.

*Coal Mining.*—FOWLER.—A long illustrated article on coals and coal mining methods of the Pocahontas field. The article deals mainly with general mining methods and the use of electric power is only occasionally mentioned. For ventilation fans are used from 25 to 40 ft. diameter, with a capacity of 300,000 to 500,000 cu. ft. of air per minute, and are driven either by an individual steam engine or an electric motor, dependent upon the location. If they are near the central power house, and within easy reach of steam, engines are used; but if they are over a distant opening in the outcrop, they are driven by an electric motor. The miners' cars are hauled out by either electric or steam locomotives, though the latter are used in the majority of cases.—*Eng'ing Mag.*, May.

*Quayside Cargo Appliances.*—CUNNINGHAM.—A fully illustrated description of some modern quayside cargo appliances and especially of electric quay cranes.—*Cassier's Mag.*, May.

## TRACTION.

*Voltage Drop in the Rails with Alternating-Current Traction.*—BEHN-ESCHENBURG.—A paper in which the author first discusses the difficulties which arise from the use of the rails as one conductor in an alternating-current traction system, on account of the disturbances set up in telegraph and telephone lines in the neighborhood, using the earth as return conductor. The Oerlikon Company has made a series of tests on the action of sinusoidal alternating currents of various frequencies on a telegraph relay, a telephone bell and a telephone receiver. The disturbances of telegraph relays and of the frequency from 15 to 50 for a given voltage at the terminals; on the other hand, the vibrations of the telephone membrane will rapidly increase for higher frequencies from 25 to 50 periods. The author concludes that disturbances in telegraph and telephone lines using the earth as return, can only be avoided if the loss of voltage in the railway rails is compensated for. He gives some actual data on measurements of voltage drop in the rails on an experimental road of 400 meters length. He then describes a system of the Oerlikon Company in which the voltage loss in the earthed rails is avoided by diminishing the current in the rails. For this purpose an auxiliary line is provided which is connected to the rails at regular intervals. Only on that section of the road on which a train is just running, the rails carry current, while in all other sections the return current does not flow through the rails, but through the auxiliary wire. The advantages of this auxiliary wire, compared with a second insulated return conductor may be questioned, but the enormous simplification of the collection of the current by means of the wheels of the train is of decisive importance. The scheme is shown in Fig. 1, which shows two sections of the road. *L* represents the auxiliary conductor, while *S* represents the rails. Each section contains a transformer, the primary being in the overhead conductor and the secondary in the auxiliary conductor. By properly designing these transformers it is possible to accomplish that the return current flows nearly throughout through the auxiliary line, and that it flows through the rails only in that section on which the car runs. When they applied this method on their experimental lines it was possible to reduce the voltage loss in the rails 25 times. The transformer must be so designed that its self-induction is very large compared with the ohmic resistance of the section of the artificial conductor and that with this transformer an e.m.f. is produced which is equal to the voltage drop in the section of the auxiliary conductor.—*Elek. Zeit.*, April 21.

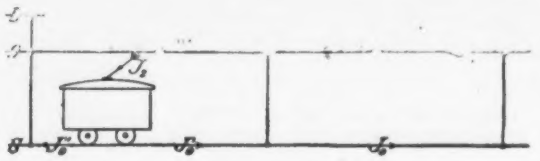


FIG. 1.—ALTERNATING-CURRENT TRACTION.

*Petrol Electric Cars.*—An illustrated description of the equipment of the petrol electric motor cars, which have recently been installed on the North-Eastern Railway in England. They have a capacity for 52 passengers. The driving power consists of a four-cylinder petrol engine, rated at 80 brake hp at 420 r.p.m. This drives a compound-wound and separately-excited dynamo rated at 55 kw, which supplies current to two 55-hp tramway motors mounted on the front bogie of the car. The exciter is driven by belting from the generator. The exciter is shunt-wound and is also used for running the 30 incandescent lamps of 16 cp and 72 volts, with which the car is lighted, and can further be used to furnish current at 95 volts for charging a secondary battery of 38 cells, each rated at 120 amp.-hours, which is fixed beneath the floor of the car. In starting up, the engine is driven for a turn or two by the generator acting as a motor and taking current from the secondary battery. Once the engine is up to speed and the voltage has been adjusted to 400 volts, the car is started by the controller in the usual way. For slow speeds the car is run with the motors in series, and for high speeds with them in parallel. The voltage of the generator is gradually increased to 530 volts by cutting resistances out of the exciter circuit and the car accelerated until a speed of 36 miles per hour is attained. In stopping the car the controller handle is moved back to the off position, and then over in the reverse direction to supply the magnetic track brakes.—Lond. *Eng'ing*, April 22.

## INSTALLATIONS, SYSTEMS AND APPLIANCES.

*Small Electric Station.*—The first part of a description of small electric plants for little rural towns and summer resorts. The first plant described is that of Mitterfels in Southern Germany, a town of 700 inhabitants. Water power is utilized with a minimum capacity of 12 hp. The two-wire, direct-current system is used with a voltage of 220. A storage battery of 125 cells with a capacity of 10 kw for a three-hour discharge is provided. The price charged for the current is 25 cents per candle-year and, if a meter is used, 12½ cents per kw-hour for lighting and 5 cents for power. The only attendant at the plant is the seventeen-year-old daughter of the proprietor of the mill, which was changed into the station.—*Elek. Anz.*, April 14.

## WIRES, WIRING AND CONDUITS.

*Eddy Currents in Cable Sheaths.*—FIELD.—The conclusion of his paper. The author remarks that in dealing with the sheath losses in multiple-core cables one should form a mental picture of the approximate distribution of the external magnetic field produced at different periods of the cycle by all the currents within. He gives several diagrams and especially one showing the successive distributions of magnetic field around a three-phase cable at six moments within half a cycle. He calculates the possible losses for a three-core, three-phase cable of certain dimensions with an effective current of 200 amp. per core for a frequency of 60. The sheath loss per mile is found to be 0.67 kw. The copper-earthed sheath directly under the lead, now advocated by the British Board of Trade, increases this loss and may bring it up to 2 kw per mile. If the cable is then let in an iron trough or is steel-armored, the total external field will again be largely increased, perhaps two or three times. The author recommends first to wind on the copper strips with a lay as different from that of the cores as possible, and then to apply a thin coat of paint before applying the lead sheath.

This coat of paint will be amply sufficient to prevent eddy currents leaving the copper, but should leakage occur from one of the high potential conductors, this insulation would be either instantly broken down or, failing this, would be sufficiently low to form a thoroughly good earth. He finally considers the case of centric cables. If, on account of faulty manufacture, some eccentricity exists, a cable carrying 200 amp. having an eccentricity of ⅛ in., would produce an e.m.f. in a parallel pilot wire, situated 4 in. away, from 3 to 4 volts a mile.—Lond. *Elec.*, April 22.

*Calculating Distribution Networks.*—MÜLLENDORF.—The conclusion of his long mathematical article in which he describes a method for calculating a distribution network. Without going into mathematical details, this method is essentially as follows: Feeding points are chosen and the "natural districts of action" are determined for the same. It is then investigated whether one of these districts is relatively too large or too small and whether the feeding points are situated in the centers of gravity of the natural districts of action. For each district the central station is to be taken into account. If this investigation does not lead to any changes in the number or position of the feeding points, the cross-section of the conductors in each district of action is calculated by the simple method of moments of current, and the possible minimum of conductor copper is determined. The network is thus calculated if one does not want to simplify further the cross-section. In the latter case one substitutes the definite cross-section for the former ones and calculates the resulting distribution of the current. The amount of copper thus found is compared with the predetermined minimum. He thinks the value of his method lies in a constant control of the consumption of copper and in the simplicity of the method of controlling it.—*Elek. Zeit.*, April 21.

*Testing Networks.*—A long editorial on regular tests of electricity supply networks. It is pointed out that they are often neglected, although periodical tests of the insulation—actual quantitative measurements—can be carried out with instruments no more delicate than those which are erected on the switchboard of every modern station, and by men possessing only a very limited knowledge of electrical engineering. It requires a little more to be able to appreciate the exact nature and principle of the tests and the suitability of the instruments used, but a station engineer should have this knowledge. The same applies to fault localization. By carrying out simple instructions there is no reason why even the shiftiest shift engineer should not be able to localize a fault within a network within a yard or two and eliminate it with far less disturbance to the continuity of supply than by means of the cut-and-try method. Of course, there is room for refinements and faults should be discovered and removed before they have become bad enough to do any damage.—Lond. *Elec.*, April 15.

## ELECTRO-PHYSICS AND MAGNETISM.

*Vacuum Tubes.*—TAYLOR.—When electrical energy passes between the electrodes of a vacuum tube, the discharge may be either direct or alternating, continuous or disruptive; but not much is known, except in the case of the continuous discharge, concerning the variations in potential which occur in any of these cases. The author has made a series of experiments in this direction, using first calorimetric methods. Afterwards it was found that better results could be obtained by means of the Braun tube, with which he could determine not only the potential difference with considerable accuracy, but could also observe the variations of potential and the frequencies of discharge. It was found that the potential rises to a certain maximum height and then suddenly falls off to a minimum value, but never to zero, although the maximum and minimum values for any tube depend upon the particular conditions under which the tube is tested. He describes a method by which the Braun tube can be conveniently used to measure high potentials, of say, 1,000 or 1,200 volts, where the fluctuations are not too great. When the limits of variations are great, say 500 volts or more, the problem is more difficult, but the author describes a method for such cases. The measurements of the author show that the manner in which the potential develops and falls off is very largely effected by the capacity of the circuit.—*Phys. Rev.*, May.

*Hall Effect in the Electric Arc.*—CHILD.—An American Physical Society paper on the phenomenon that if two carbon pencils are so placed in an arc that there is little or no potential difference between them, a potential difference is produced by creating a magnetic field about the arc. This may be as high as 1.5 volt. It appears to be similar to the Hall effect in metals, and if it is this effect it would show that the negative ions have a velocity enormously greater than that of the positive. He describes several observations made concerning this effect, but says that no definite explanation can at present be given.—*Phys. Rev.*, May.

*Conductivity and Electrostatics.*—VON NICOLAJEW.—A paper in which the author points out that conductivity should enter into electrostatic formulæ as often as the specific inductive capacity, and that the neglect of the factor makes modern electrostatics too much of a fiction. He quotes some experiments in electrostatics, in which the conductivity plays a more important part than the inductive capacity, and yet is usually left out of account. A piece of paraffin suspended in air beside a charged conductor is attracted by the latter owing to its higher dielectric constant. If the conductivity of the air were very much higher than that of the paraffin, the latter would be repelled instead. If the medium and the suspended body have nearly the same dielectric constant, the effect of the conductivity may very well mask that of the dielectric constant.—*Phys. Zeit.*, April 1; Lond. *Elec.*, April 22.

REFERENCE.

*Radioactivity.*—MARCKWALD.—A paper read before the Berlin Electrical Society in which he gives a review of the researches of various investigators on radioactive substances.—*Elek. Zeit.*, April 21.

## ELECTRO-CHEMISTRY AND BATTERIES.

*Storage Batteries.*—A review of new developments in the storage battery line during the last year or so. It is based mainly on patent specifications, but it is pointed out that most of the patents in this field would not have been taken out if the inventors had not been quite inexperienced. It is stated that the large manufacturers now care less and less for inventions which may be theoretically pretty but are practically worthless, and they try to make accumulators of the most simple construction. For this reason the makes of different firms have become so similar that the accumulator business has nearly become "trading in lead." Concerning electrolytic methods of formation, it is stated that all methods which have been found practically effective, are based on the use of an anion which is able to form a lead salt, soluble in water. Under suitable conditions lead peroxide is formed at once, without a previous production of lead sulphate. It is said that this is an interesting reaction which appears to be related to the passivity of iron, chromium and nickel electrodes and which should be studied more thoroughly not only for technical but also for scientific reasons.—*Zeit. f. Elektrochemie*, April 15.

*Glass Furnace.*—A note stating that electric furnaces are giving good results at the large glass factories at Matrey in Tyrol and at Plattenburg, in Westphalia. In the latest type of furnace the raw material, before it is exposed to the heat of the arc, is made into a paste with water. It is then pressed and dried and finally it passes in the shape of a ribbon through the arcs between a number of electrodes, out of which it emerges completely fused. The heating is chiefly done by radiation and care is taken to prevent impurities from carbon entering the molten glass.—Lond. *Elec. Eng.*, April 15.

*Chemical Engineers.*—HERRESHOFF.—A long abstract of an American Chemical Society paper on the training of the chemical engineer. What is needed now in chemical industries is not a chemist, pure and simple, but one who has, besides chemical training, a full knowledge of physics and mathematics and a thorough training in engineering. There was a long and animated discussion in which chemical engineers and professors equally participated. There was unanimity concerning the desirability of such a training, but it was doubted that this could be accomplished with the present system of university instruction.—*Electrochem. Ind.*, May.

REFERENCES.

*Laboratory.*—BURGESS.—An illustrated description of the electrochemical equipment of the University of Wisconsin, with an account of the research work which has been done there in recent years.—*Electrochem. Ind.*, May.

*Electric Furnace.*—WRIGHT.—A long illustrated description of various electric furnace processes either in actual operation or proposed in patent specifications.—*Cassier's Mag.*, May.

### UNITS, MEASUREMENTS AND INSTRUMENTS.

*Practical System of Units.*—ROBERTSON.—A communication in which he remarks that four fundamental quantities are really necessary for a system of electrical units, length, mass and time usually being three of them. In the electromagnetic system, magnetic permeability is taken as the fourth, that of air being the arbitrary unit. The writer recommends to take as the four fundamental or arbitrary units the meter, kilogram, second and ohm (defined from a mercury or wire standard). We thus get a complete system which includes all the established practical electrical units and gives units which have a convenient magnitude for most purposes. Instead of resistance we may take electric quantity, with a coulomb defined from the electrolysis of silver, as the fundamental unit. One advantage of this would be that the dimensions in terms of the fundamentals would have no fractional indices, but the material standard is not quite so direct. He recommends to define the permeability and the specific inductive capacity in such a way that the well-known $4\pi$ disappears in most formulas; under these conditions the permeability of air is $4\pi \times 10^{-7}$ henrys per meter, and its specific inductive capacity $(1/36\pi) \times 10^{-9}$ farads per meter. Instead of kilogram he recommends to write k'gram or kram. The name newton is suggested for the unit of force ($10^5$ dynes), but new names should not be given to other units. Compound names should be used like volt-second for the unit or flux and volt-second per square meter for the unit of flux density, etc. The giving of new names only results in confusion. It is also undesirable to have too many prefixes for sub-units. Only those representing powers of 1,000 have been found really useful and the others should be abandoned.—Lond. *Elec.*, April 22.

*Electrical Notation.*—EMDE.—A communication discussing the use of various types of letters for notation in electrical engineering and in physics in general. His suggestions cannot be shortly abstracted, but it may be mentioned that the author does not propose to try and get an international system of notation. He thinks it would be valuable only on paper, but not in practice. "German books are mostly read by Germans. If they are translated the symbols may also be changed. If a foreigner overcomes the difficulties of the German language, German symbols will not disturb him." He does not think that *W* for resistance and *A* for work (derived from the German words Widerstand and Arbeit) would be unsuitable for international use.—*Elek. Zeit.*, April 21.

*Direct-Reading Instruments.*—EDGCUMBE AND PUNGA.—The conclusion of their paper read before the British Institute of Electrical Engineers, on direct-reading measuring instruments for switchboard use. They describe methods of connecting wattmeters for the measurement of power.—Lond. *Elec.*, April 8. The extended discussion which followed the paper is abstracted in Lond. *Elec.*, April 8 and 22. In an editorial it is said that instrument users rather than instrument makers should derive most profits from the discussion and from the paper. They can learn what accuracy to expect from the instruments and one source of serious errors which is too often disregarded has been pointed out, viz.: parallax. Nignoles stated this is especially troublesome with the "edgewise" instruments, in which the angle between the direction of the observer's vision and the instrument scale differs enormously for different readings. It is only on account of the parallax error that "set up" or "open scale" instruments are more accurate than those with equally divided scales, for the percentage accuracy of the instrument itself if the same in the two cases, if the instruments are otherwise similar. Ayrton called attention to the stray field due to the bus-bars. Some switchboards are designed in such a way that the instruments could not possibly be accurate unless they were calibrated in position, and even on the best-designed direct-current switchboard there are magnetic fields, dependent on the current through the bus-bars, which may be troublesome if the instruments are not sufficiently well sheathed. Nalder pointed to an error that could arise from the screening iron case itself.—Lond. *Elec.*, April 22.

### TELEGRAPHY, TELEPHONY AND SIGNALS.

*Wireless Telegraphy.*—BRAUN.—An illustrated article on methods for increasing the transmitter energy of wireless telegraph systems. In so-called closed circuit ("coupled") systems the open circuit of the transmitter is not directly excited, as was the case with the first Marconi arrangement, but is connected with an oscillatory circuit containing condensers and self-induction and serving as an energy reservoir. There are two theoretical possibilities of increasing the energy; first by increasing the capacity, and second by raising the charging voltage. The author shows, however, that both methods have their limitations. He has, therefore, searched for methods which—without altering the frequency of oscillations—would allow the energy disposable for radiation to be decreased in such a manner that the economy of a single jar circuit is retained. Various arrangements of this kind are described. One is shown in Fig. 2 in which the condensers, *C*, are charged in parallel and are connected for

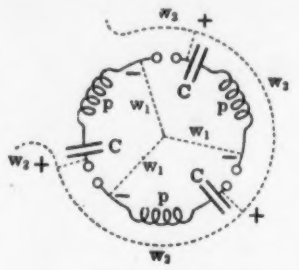
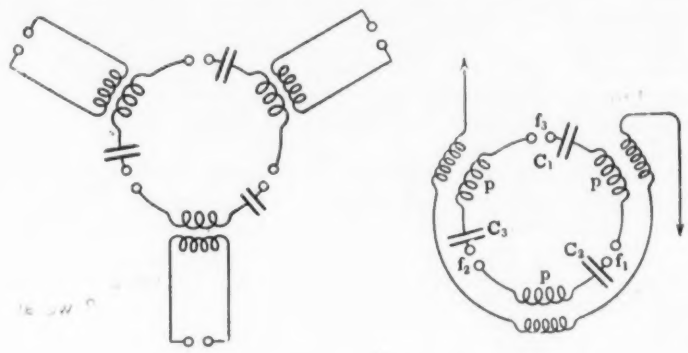



FIG. 2.—WIRELESS TELEGRAPHY.

this purpose with non-inductive or inductive resistances, *w*. As soon as one spark occurs, the whole circuit closes within itself. The large charging resistances are then practically inactive. If wholly unforeseen peculiarities of the spark do not exist, then the spark will also act in the same manner as in a single system. It is possible to obtain, as in Fig. 3, the same effects (final voltages, heating effects, etc.) simultaneously on each of three artificial transmitters which are tuned to one another. The same efficiency is, therefore,




FIGS. 3 AND 4.—WIRELESS TELEGRAPHY.

obtained with a number of oscillatory circuits as applies to each one of them. There is no appreciable difference in phase. Fig. 4 indicates the arrangement for series connection. Various other arrangements are described which show that it is possible to increase—without altering the frequency of oscillation—the energy of the single system whenever the energy limits in such single systems are reached. —Lond. *Elec.*, April 22.

*Wireless Telegraphy.*—SEIBT.—A long mathematical article on the design of resonance transformers for use in wireless telegraphy. The author remarks that the hopes that had been set on tuning the transmitting and receiving stations to the same frequency have been fulfilled in practice only to a very small degree. In order to protect one's self against disturbances from other stations, the only means is at present to diminish artificially the receiver intensity and to increase the transmitter intensity. This means the necessity of radiating larger and larger quantities of energy. This is now possible. The author finally asks whether Marconi utilizes the resonance of the slow oscillations in his large stations. He says that, according to his calculations, this would be possible only if he had provided his transformers with an air-gap of several centimeters.—*Elek. Zeit.*, April 17.

*Nickel in the Core of the Marconi Magnetic Detector.*—An account of experiments on the changes of sensibility of a magnetic detector as a function of the varying distances between the moving magnet and core. Since nickel is more susceptible than iron in weak magnetic fields and less susceptible in strong fields the author thought that a more uniform sensibility for varying distances might be obtained by making the core of nickel. He found that the sensitiveness of the detector with a nickel core was not very different from the sensitiveness when an iron core was used. Contrary to ex-

pectations, however, the sensitiveness with the nickel core appeared to be greater in stronger fields and with the iron core in weak fields. Both show a maximum of sensitiveness at a short distance from the magnet, the maximum for nickel being the farther removed. A mixed core consisting of annealed piano wire and hard-drawn nickel wire produces a more sensitive detector than using a core of piano wire alone.—*Phys. Rev.*, May.

REFERENCES.

*Munich.*—A profusely-illustrated description of the new telegraph station in Munich.—*Elek. Zeit.*, April 21.

*Municipal Telephony.*—BENNETT.—An abstract of a paper on the history and equipment of various British corporation telephone exchanges.—Lond. *Elec.*, April 22.

*Wireless Telegraphy.*—BRAUN.—A communication discussing at some length the question of priority between Marconi and himself in the employment of the oscillatory circuit in the transmitting system of wireless telegraphy installations.—Lond. *Elec.*, April 15.

## New Books.

WHITTAKER'S ELECTRICAL ENGINEER'S POCKET BOOK. By Kenelm Edgcumbe. London: Whittaker & Co. 444 pages, 149 illustrations. Price, 3 shillings, 6 pence.

While this book belongs in the familiar class of engineers' reference books, it differs in plan from most of those which have previously appeared in that the compiler does not content himself with assembling all the formulæ and empirical data that may be available on given subjects, without any indication to the reader as to which of conflicting rules or formulæ are most generally used or accepted; a clear-cut synopsis of each subject is given. The first 47 pages are devoted to mathematics and physics and contain the usual logarithmic and trigonometrical tables, tables of weights and measures, circular functions, etc., as well as brief discussions of the elementary principles of mathematics and physics. Next, practical mechanics are treated briefly, and then the electrical part proper is reached. There are imperfections, of course; whoever saw a first edition free of them? In the table of units, for example, the practical English unit of acceleration is said to be feet per minute per minute and that of angular velocity to be revolutions per minute. On page 98 we are told that "the C. G. S. unit of inductance is, therefore, the unit of length, i. e., the centimeter," which is news, to say the least. On the whole, however, the subject matter is accurate. The sections on measuring instruments, direct-current and alternating-current dynamos and motors and testing generators and motors are particularly good. The methods of dynamo and motor design outlined in the dynamo and motor sections are thoroughly practical, although somewhat too condensed to be useful without the aid of the more detailed treatment to be found in books devoted exclusively to that subject. The section (if two pages may be so termed) on storage batteries is about as unsatisfactory as those just mentioned are praiseworthy; the paltry amount of information that is given is accurate, but the scope is so limited as to make the discussion negligible. This is also true of arc and incandescent lighting, which has been accorded the space of four pages. With the proper balancing, which the book will doubtless receive in the course of future revisions, Mr. Edgcumbe's work will be of much value to his fellow engineers.

DIE ELEKTROMETALLURGIE DER ALKALIMETALLE. By H. Becker. Halle: Wilhelm Knapp. 128 pages, 83 illustrations. Price, 6 marks.

This work on the electrometallurgie of the alkali metals, containing 135 pages and 83 figures, forms the ninth volume of the "Monographien über angewandte Chemie," but in itself forms an independent work. The first few pages are devoted to the methods of obtaining the alkali metals by chemical means, and as this lays practically outside the scope of this work, little stress is laid on this chapter. The author's object in introducing this chapter is evidently only to show in how far the chemical and electrochemical processes are identical, and then to demonstrate how much easier and more economically the processes can be performed with the aid of the electric current. The rest of the work is a careful and full description of the existing patents for the manufacture of the alkali metals, to which Becker has added his remarks.

The greatest stress has been laid on those processes which are in actual operation to-day; in other words, those which proved commercially successful. Among the successful ones belongs also a process of the author's, and the remarks he adds to some of his competitor's processes, are somewhat bitter and sometimes misleading. In more than one case his information is erroneous and lacks accuracy. He thus states that he does not know whether Castner's process in England is operated by the Castner-Kellner Company or by the Aluminum Company, and it certainly would not have cost him much trouble to ascertain, that the process is operated by the Castner-Kellner Alkali Company, Limited, in Runcorn. The information and illustrations about the Darling process are very interesting, but instead of stating that the same did not prove a commercial success and never passed its experimental stage, he states that it is in operation at the Harrison Bros'. works, in Philadelphia, which is entirely erroneous, although the experiments were carried out in their factory. He also hints that possibly the Darling process is of more commercial value than Castner's process, which is operated at Niagara Falls. Castner's process seems to be a thorn in the author's side; but this is explicable, as his (Becker's) process is operated at the Usines de Rioupéroux works in Isère, France, and Castner's at the Cie de Electro-Chimie, also in Isère. The author tries to minimize the value of Castner's process at all points, but we must consider that this process is possibly the best, as it is the only one which is operated in the United States, England, Germany and France; whilst Becker's process is only working in France and perhaps now in Germany, but apparently not with equal success to Castner's.

In his chapter on the uses of sodium, his information on its application for the production of cyanide is entirely wrong. He states that most of the cyanide produced at present is made by the older method with potassium ferrocyanide and sodium, and that the newer method of making the same, with sodium, charcoal and ammonia gas, is not in operation; this hardly coincides with the fact that both in the United States and Germany certain cyanide factories dispensed with the first method and are, since at least four years, successfully operating the second process, even at the low prices they have to meet to-day. One can, however, easily reckon out that the latter process would still be the cheapest process for the manufacture of cyanide, even if the results were not of the highest efficiency. Becker ends his work with three very complete tables, giving the numbers of the patents described, their inventor and other interesting information in regard to the same.

FREE-HAND LETTERING. By Victor T. Wilson. New York: John Wiley & Sons. 95 pages, 13 illustrations. Price, $1.00.

Much of the draughtsman's success depends upon the appearance of the finished drawing, and no part of it contributes so forcibly to the production of a pleasing impression as correctly designed and neatly executed lettering. In the past draughtsmen's alphabets galore have been published, but these have usually been merely pictures of various styles of lettering which the draughtsman was left to copy either enlarged or reduced, as might suit his purpose.

The present volume departs distinctly from previous precedents in that it attempts to be a scientific treatise upon the principles of lettering, and endeavors to convey the methods by which titles should be designed and executed, rather than to furnish examples purely for copying.

The work consists of seven chapters, the first of which deals with the history of alphabetic characters and the principles which enter into the construction of roman and gothic letters. Chapter II takes up the question of spacing and shows that there is no mathematical rule governing proportioning but that spacing must be altered with the type of letter and with the effect which the draughtsman desires to produce. Then come instructions in the use of the pen and in that off-hand lettering which is becoming more and more popular in all classes of drawings. Chapters IV and VI deal respectively with the designing of titles and the design of letters. Chapter V introduces instructions for special technical lettering such as that required for photographic reproduction, while finally Chapter VII takes up the various mechanical aids to good lettering.

The underlying thought in the volume is that lettering like other forms of art is a method of expression that cannot be done purely mechanically, and that unless the draughtsman is able to design free hand it is impossible for him to become a perfect letterer.

ELETTROCHIMICA. Soda Caustica, Cloro e Clorati Alcalini per Elettrolisi. Ing. F. Villani. Milan: Ulrico Hoepli. Price, 3.50 lire.

This is one of the manuals of Hoepli's well-known series. Three hundred pages deal with electrolysis of aqueous solutions and 15 with electrolysis of fused salts, but of the great number of industrial processes, in use on a large scale, those best known in this country, like the Castner-Kellner and the Acker processes receive no attention. On the other hand, the author's own process is described at length and a large amount of interesting information is given concerning it. The chapters on volumetric analysis and on the continual supervision of an electrolytic caustic soda and bleaching plant also contain much useful information for the specialist in this field.

## National Association of Manufacturers.

This Association will hold its ninth annual convention on May 17, 18 and 19 at Carnegie Hall, Pittsburg. The headquarters are at the Hotel Schenley, nearby, in a pleasant part of the city. A good convention is expected by Mr. Marshall Cushing, the secretary.

## Electrical Exhibits at the Opening of the St. Louis Exposition.

THE large number of completed and operating exhibits, and the condition of the Electricity Building on the opening day, April 30, received favorable comment from all visitors. While there is considerable installation work to be done in many spaces, on that Saturday exhibits were attractively arranged, aisles were cleared, and the building as a whole made a neat appearance. The accompanying photographs were taken of the several exhibits as they appeared at that time.

The handsome booth of the Bristol Company is located in Section 36, and contains a large variety of recording instruments, for pressure,

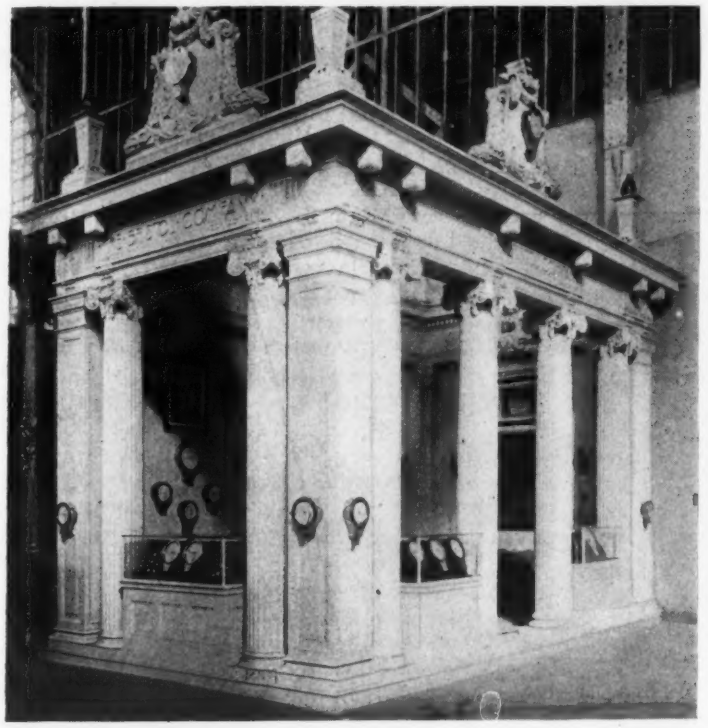


FIG. 1.—BRISTOL COMPANY'S BOOTH.

temperature and electricity. These instruments record continuously and automatically with ink, upon graduated revolving charts, all changes that occur in pressure, temperature or electricity, so that the record after a period of twenty-four hours or more may be observed at a glance. Many of these instruments are in actual operation, and demonstrations will be made for visitors, showing the manner of construction, the scientific principles upon which the operations depend, and the extreme sensitiveness and accuracy that it is possible to attain in instruments of this character without rendering them too delicate for commercial application. Recording pressure gauges are shown for all ranges from full vacuum to 10,000 pounds per square inch. Also recording thermometers and pyrometers for ranges from 60° below zero to 1,000° F. The recording thermometers are made in many varieties of form to make them applicable to all industrial requirements, especially where it is desired to record tem-

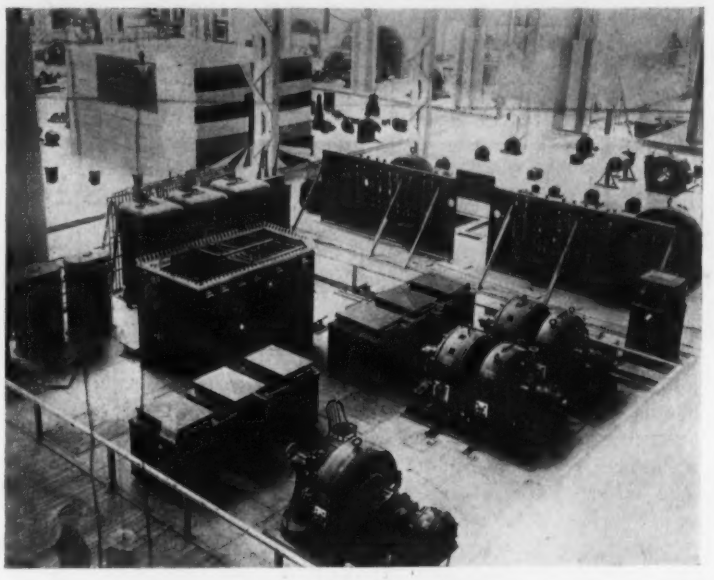


FIG. 2.—SUB-STATION.

peratures at a distance from the source of heat. Recording volt, ampere and wattmeters, for both alternating and direct current, are shown, including a great variety of ranges suited to commercial demands for different voltages and currents in electric light, power and railroad plants. Recording water gauges in operation and a new instrument designated as a thermometer-thermostat will be shown.

The exhibit of the Baldwin Locomotive Works in the northwest corner of the building comprises electric locomotives and electric

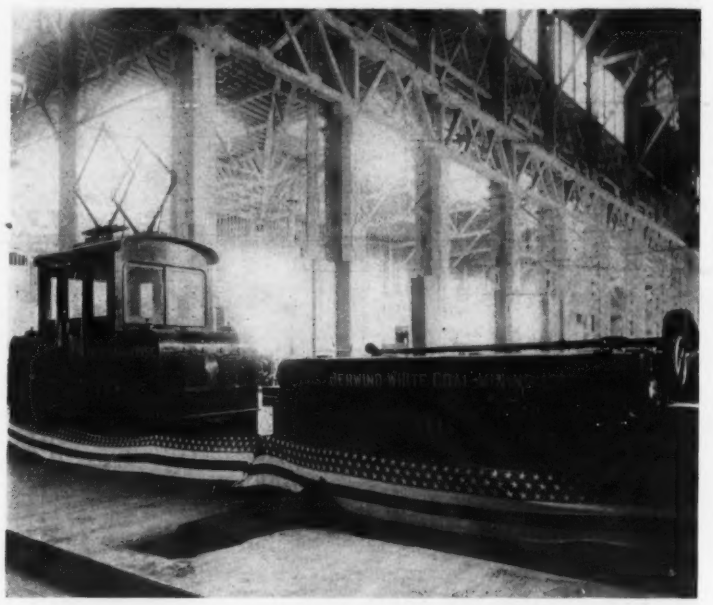


FIG. 3.—BALDWIN LOCOMOTIVE.

railway trucks for various conditions of service. The locomotives shown in the photograph include the following: A ten-ton machine equipped with two 50-hp Westinghouse railway motors constructed for the Berwind-White Coal Mining Company, adapted for heavy and frequent service in the coal mines of Western Pennsylvania; a fifteen-ton locomotive constructed for the Norfolk Coal & Coke Company, for use in the mines of West Virginia, where coal has to be handled on the surface in all kinds of weather and conditions of track; an electric locomotive built for surface work, of special design, permitting powerful motors of standard construction to be mounted, adapted to run on track of extremely narrow gauge. The machine exhibited is for operation on a track gauge of 24 in., and

at the same time carries two Westinghouse railway motors of 35 hp each. The electric railway trucks consist of one constructed for the Interborough Rapid Transit Company, of New York, and designed for heavy elevated passenger service; one for the Illinois Central Traction Company, designed for high-speed interurban service; and also one for light work. All trucks shown are of M. C. B. design and equipped with Westinghouse Electric & Manufacturing Company's railway motors.

The operating exhibit of the Bullock Electric Manufacturing Company represents the high development of this company as a manufacturer of electrical apparatus of all kinds. The space includes all of Section 15, and is 54 by 104 ft. In the center is erected an ornamental pavilion, handsomely finished and comfortably furnished. Motors direct-connected to machine tools, requiring variable speeds and operating on the multiple-voltage system, in practical operation, are shown in the Bullock exhibit. The main generator furnishes current at 250 volts, and a balancer splits the voltage into 90 and 160 volts for distribution. An engine lathe, a milling machine, a boring mill and a shaper, all direct driven by Bullock motors, will be operated by this set. This gives three fundamental speeds, but by the proper insertion of shunt field resistance twelve speeds in the forward direction are obtained, and nine in the reverse. The controller used in connection with this system is so constructed that a careless operator cannot stop the handle between the voltages. The motors when enclosed are supplied with spun metal covers, particularly adaptable for dirty, damp or dusty places.

The five alternating-current generators on exhibition range in size from 50 to 350 kw in size. An interesting feature in the design of these alternators is that the magnetizing coils of the field are

FIG. 4.—BULLOCK ELECTRIC AND MANUFACTURING COMPANY'S EXHIBIT.

made of strip copper wound on edge. This permits as high peripheral speeds as are possible for steel wheels without windings.

The exhibit includes two heavy street car trucks, on each of which are mounted two 50-hp Bullock street car motors. These are duplicates of the 300 motors now being supplied to the Boston, Haverhill & Manchester Electric Railway Company. The motors will be turning over with current at 500 volts furnished by the 500-kw Bullock railway rotary converter. Alternating current is obtained from the Bullock 3,500-kw, 6,600-volt generator installed in the Allis-Chalmers Company's exhibit in Machinery Hall, reduced in a Bullock 150-kw, oil-filled, self-cooled transformer. There are three of these transformers to be seen in the exhibit. The case of the transformer is made of corrugated sheet steel, which makes it considerable lighter than if it were made of cast iron, as is usually the custom.

The Western Electric Company's space occupies 5,764 sq. ft., having frontage on two main aisles of 88 ft. 5 in., and a width of 65 ft. 2 in. In the center is a motor-generator equipment, consisting of two 100-kw frames, the motor side taking current at 500 volts, and the generator side delivering current at 220 volts. This unit operates in conjunction with a 15-kw compensator, permitting the use of 110-volt current. The center space also contains two switchboards, one for controlling the operation of the apparatus receiving current from the motor-generator, and having all the necessary switches, circuit-breakers, ammeters, etc. The other board is for display purposes only, and on it are circuit-breakers, knife switches, voltmeter switches and kindred apparatus.

In the extreme northeast corner of the space a small machine shop is installed showing the actual operation of modern machine tools driven by Western Electric motors on the three-wire multi-voltage system. West of the machine shop are several direct-connected and belt-driven generators, and a number of Cornish cycle engines direct-connected to generators; these sets being especially for marine use. In the northwest corner of the space are a line of power motors arranged in the form of a pyramid, the smallest ones at the top. In the southwest corner is a series alternating arc light

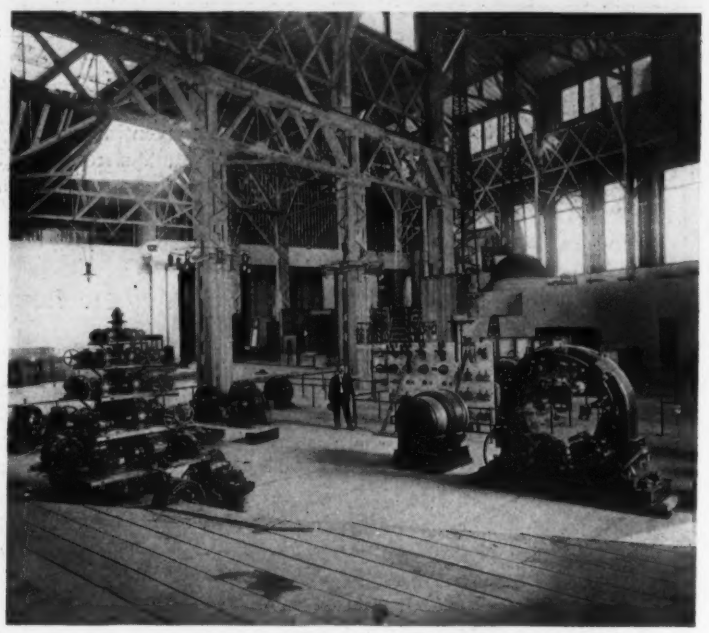


FIG. 5.—WESTERN ELECTRIC COMPANY'S EXHIBIT.

equipment, consisting of a full line of transformers, regulators and switchboards. Opposite this are ornamental arc lamp stands from which are suspended various types of arc lamps. There are also a number of sewing machine motors in operation. Fan motors and ceiling fans will be distributed throughout the space, suspended from overhead, and a number of boards containing supplies manufactured by the leading companies throughout the country.

Above the space of the Electric Storage Battery Company is a large map of the United States, approximately 40 ft. by 25 ft., which indicates the location of each of the 1,700 electric battery installations made by this company. These are shown by different colored spots of isinglass about one inch in diameter, which will be illuminated by incandescent lamps mounted behind the map, the different colors being as follows: Red lamps for railway plants; blue lamps for Edison plants; white lamps for telephone and telegraph plants, and green lamps for isolated plants. Beneath the map is a model battery house, constructed on exactly the same lines as one forming part of a power house or sub-station equipment. The battery house is of fire-proof and acid-proof construction, properly ventilated and with acid-proof brick floor. A small booster is operated in connection with this battery, and a complete switchboard installed with recording instruments to show what work the battery is doing on a fluctuating load, and also how constant the load is maintained on the generator or bus-bar circuit. The fluctuating load is provided either by switching on or off banks of lamps, or starting up a motor load with brake attached. A railway booster of about 100 kw complete with switchboard and regulator is shown, the motor being connected so that the machine can be run light. A complete line of switchboards for Edison lighting work, isolated plants, railway booster equipment and line batteries; a set of three motor-driven end cell switches connected up complete with motor control and indicator apparatus; complete cells for railway work, such as are installed for the St. Louis Transit Company, and cells of smaller type are set up to show the various types and capacities. A complete exhibit of vehicle batteries for automobile and locomotive work is shown, as well as a collection of photographs and curves as to existing plants and results obtained in them.

The exhibit space of James Clark, Jr., & Co. contains a group of electrically-driven machine tools, small motors and generators and

FIG. 6.—EXHIBIT OF THE WESTON ELECTRICAL INSTRUMENT COMPANY.

FIG. 9.—NATIONAL CARBON COMPANY'S BOOTH.

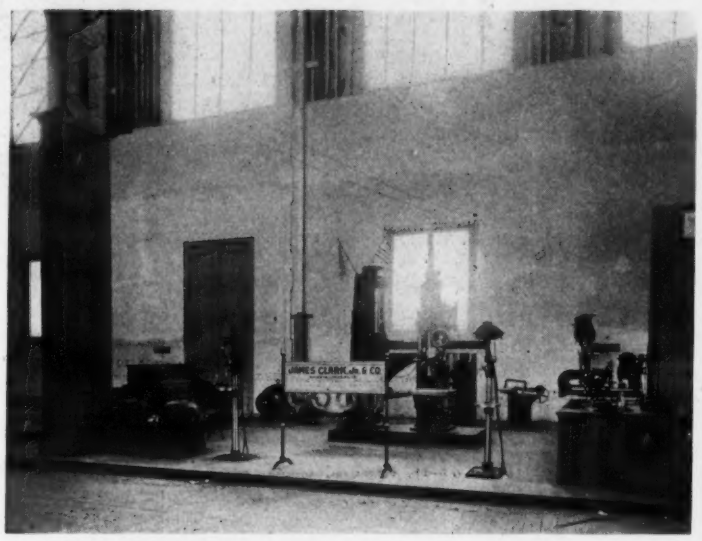



FIG. 7.—JAS. CLARK, JR., & CO.'S EXHIBIT.

FIG. 10.—JAPANESE EXHIBIT.

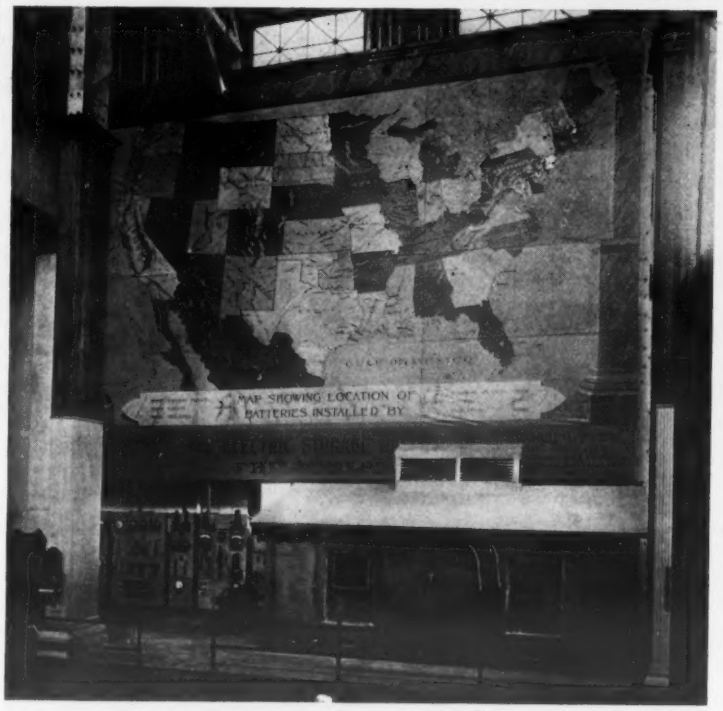



FIG. 8.—ELECTRIC STORAGE BATTERY COMPANY'S EXHIBIT.

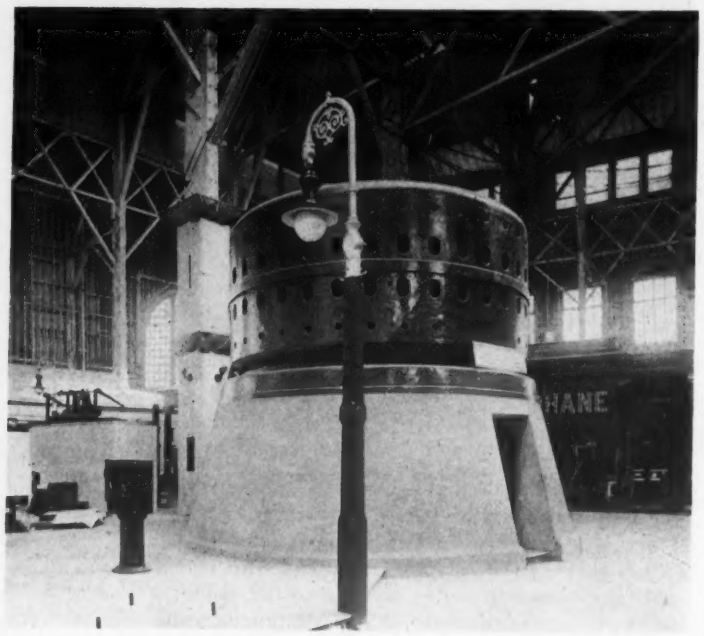


FIG. 11.—PART OF GENERAL ELECTRIC COMPANY'S EXHIBIT.

SOME OF THE ELECTRICAL AND KINDRED EXHIBITS AT THE ST. LOUIS EXPOSITION.

a new variable-speed motor. These electrically-driven tools all have their driving motors built into the machines forming integral parts of them. The exhibit includes a five-foot radial drill, 22½-in. upright drill, automatic armature disc notching machine, a machine for winding magnet coils for electrical machinery, a 14-in. water tool grinder, bench grinder, shop saw, sensitive drills and several sizes of portable drills and center grinders. The radial drill has the driving motor built into the head of the machine, and drives the spindle through the least possible number of gears. The motor is of their variable-speed type, with nine speeds, which, in connection with the lock gears, gives eighteen speeds for the spindle, any of which are instantly available. The lock gears can be thrown in without stopping and the spindle can be instantly reversed for tapping. The spindle has a quick return, eight positive feeds, depth gauge and automatic stop. The arm is raised and lowered by a plain series vertical motor in the top of the column controlled by the small handle on the side of the column. The column swings on ball bearings and can be clamped in position by a lever. The 22½-in. drill has the same features of control as the radial. A 12-in. sensitive drill with motor directly on the spindle demonstrates the adaptability of the electric motor for machine tool driving. The notching machine and magnet winder are machines which will be of special interest to electrical manufacturers, the magnet winder especially being a new development in this class of machinery. The small electrically-driven breast drills are shown in several sizes. There is in operation a 9-kw motor-generator taking current from the 500-volt mains, and supplying the exhibit with 220-volt current, all of the machines being connected so that they can be shown in operation. Several standard small motors are shown, and a new variable-speed motor, designed especially for direct connection to machinery. It has two commutators and two armature windings, having a ratio of five to three, giving three primary speeds, three variations of each of these being made by field resistance giving a total of twelve speeds at high efficiency.

Japan for the first time has made an electrical exhibit, and, to the engineer, it will appear strange to see Japanese characters upon the name plate of a motor. The material and workmanship of the electrical apparatus are of high order, and it will be interesting to ascertain if the operating characteristics are equal to American and European makes. A small steam-driven generator set is exhibited by the Shibaura Engineering Works of Tokio, also a 150,000-volt testing transformer. The Oki Company, of Tokio, exhibits a fine assortment of telegraph and telephone instruments and switchboards. Several models and photographs of hydraulic electric power stations are shown, as well as charts indicating the advance of electrical industry in the empire. The exhibit is enclosed in a handsome booth of Japanese design and erected by native workmen.

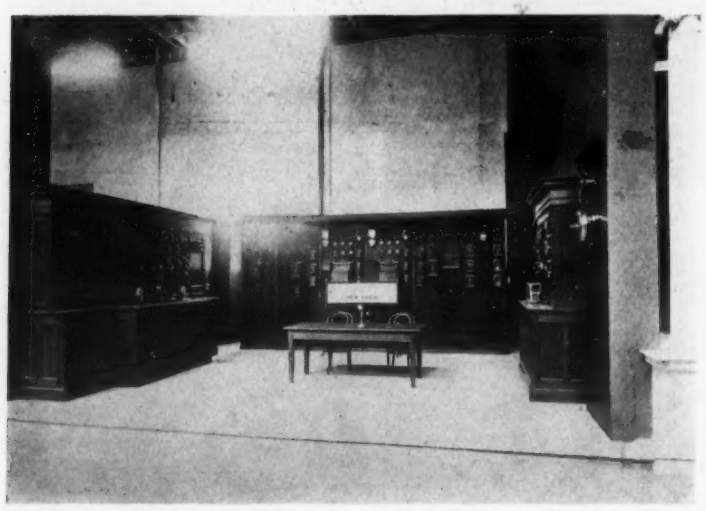


FIG. 12.—AUTOMATIC FIRE ALARM COMPANY'S EXHIBIT.

In the French section the exhibit of the Compagnie Francaise des Cables Telegraphiques consists of samples of cables installed in various parts of the Atlantic Ocean and Gulf of Mexico. The damaged cable shown in the foreground of the exhibit was one removed during the repair of Porto Plata, Martinique, cable after the eruption of Mount Péleé in Martinique, May, 1902.

The full-sized model of the latest type of 10,000-kw generator for the Niagara Falls power plant may be seen in one of the engravings. This occupies the southwest corner of the General Electric Company's space. Its great size makes it a conspicuous object in the building.

The Brazilian space is taken up by a display of telegraph, telephone and fire alarm apparatus, porcelain insulators and maps and charts showing the extent of telephone and telegraph lines in the great republic.

One illustration shows the traveling crane over the main aisle along the west side of the building. The craneway has a span of 57 ft. 5½ in. Upon this is a four-motor, 30-ton electric crane furnished by Pawling & Harnischfeger. A 20-hp, 220-volt motor gives a horizontal speed of 250 ft. per minute, an 8-hp motor gives a trolley transverse speed of 150 ft. The main hoist is equipped with a 30-hp motor, having a speed of 25 ft., and the auxiliary hoist with a 15-hp motor, and has a travel from 30 to 90 ft. per minute. The crane proved very serviceable in the installation of exhibits.

FIG. 13.—PAWLING & HARNISCHFEGER CRANE.

The De Forest wireless telegraph station in the Electricity Building consists of three 75-ft. towers, the bases of which may be seen in the illustration. The sending and receiving instruments are placed near the center of the triangle formed by the towers. The ability of wireless telegraphy to maintain simultaneous communications between a number of stations without interference will here be determined. It is largely with this in view that the De Forest Company decided to equip so large a number of stations upon the World's Fair grounds. With eight stations, all in operation simultaneously, some sending messages only a few hundred yards and others to Chicago and Springfield, conclusive tests can be made under adverse conditions. The interference to which the stations in the Electricity Building are subjected from high-tension machinery of all descrip-

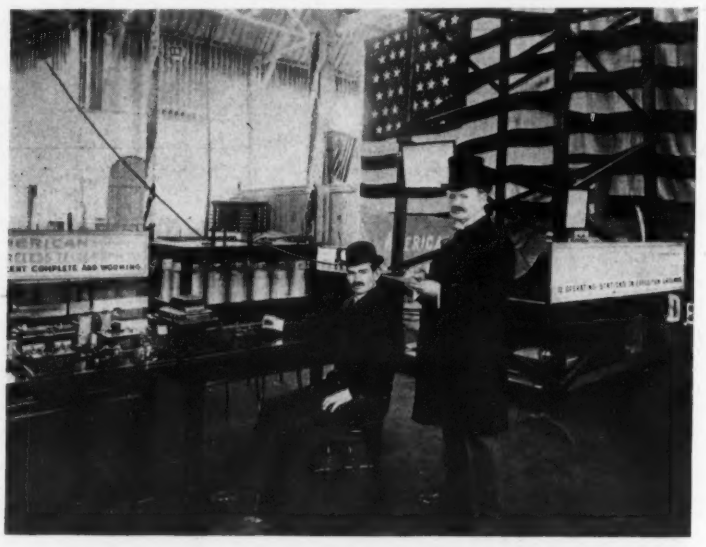


FIG. 14.—DE FOREST WIRELESS TELEGRAPH EXHIBIT.

tions, such as X-ray apparatus, large static machines, induction coil discharges, etc., subjects the tuning methods employed to far greater tests than any ordinary multiplicity of wireless telegraph messages.

The booth of the National Carbon Company is made up entirely of immense blocks of carbon cut in the form of columns, arches, etc., and set together like large timbers. So large are some of the pieces that they appear to be cut out of black logs.

The booth of the Weston Electrical Instrument Company is one of the most beautiful in the building, and it contains a very fine display of the standard electrical instruments made by this company.

## Westinghouse-Parsons Steam Turbine.

We give herewith some illustrations showing some details of the Westinghouse-Parsons steam turbine in its latest form. Fig. 1 is a view of a 600-hp turbine open for inspection, and Fig. 2 that of a rotor, a workman being shown busily placing in position the "teeth" or small vanes upon which the steam acts. As has been explained in previous descriptions, the rotor carries numerous rings or blades or vanes ranged in stages of sets of constantly increasing diameter. Corresponding rings of similar vanes of reverse curvature are carried on the stator or cylinder, which latter serve as guides for the steam in passing from one stage to the rotor vanes in the succeeding stage. The precise curvature and arrangement of the vanes are the result of both theory and exhaustive experiment. They are assembled by a caulking process which holds them so firmly that they will pull in two before they can be drawn out by force, but yet admit of great ease in repair.

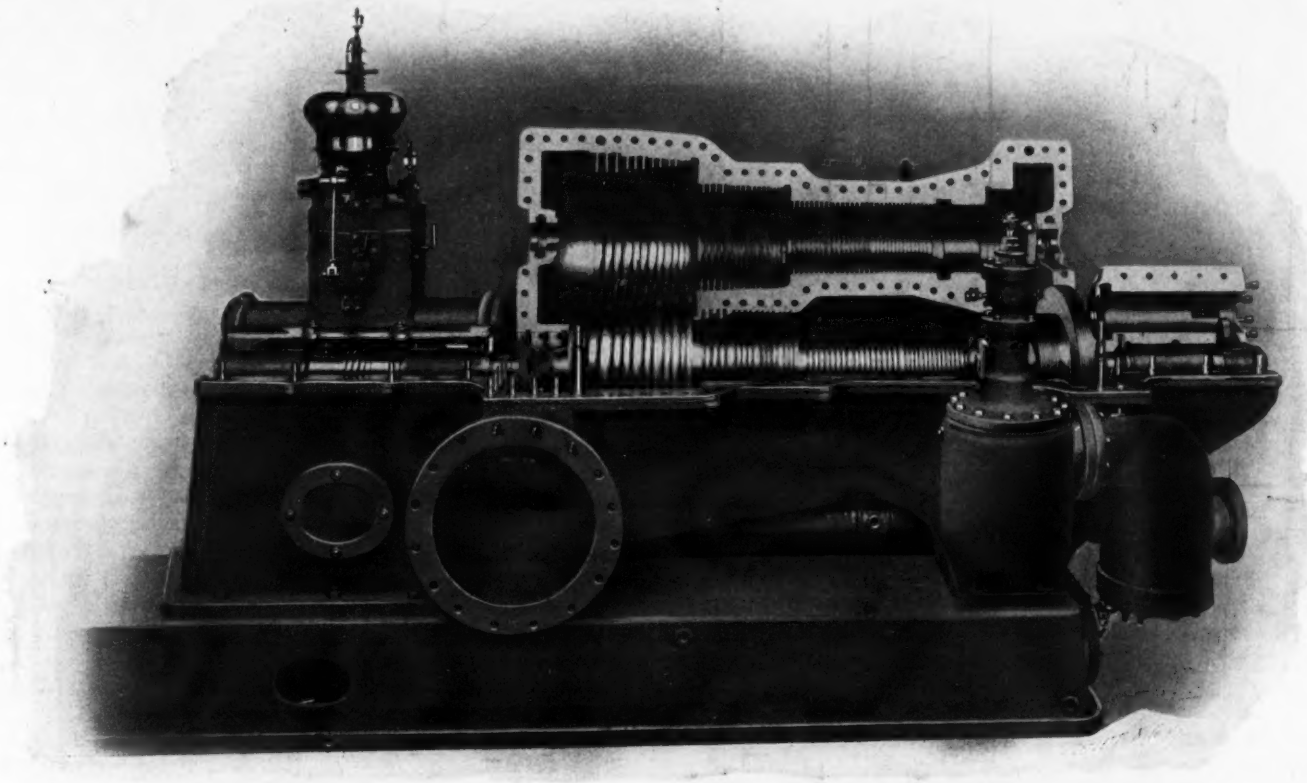


FIG. 1.—600-HP TURBINE, OPEN FOR INSPECTION.

The interior proportions of the stator conform to the rotor and its parts. An annular compartment at the beginning of the expansion space admits the high-pressure steam. Beyond the expansion space a larger opening provides for the exhaust. Opposed to the sets of blades the rotor also carries rotating balance pistons equal to the number of the stages of the rotating blades. Each piston is of such diameter as to exactly balance the axial thrust of the steam against its corresponding stage of blades. The rotor also carries a series of thrust bearing rings whose sole duty is to maintain an exact relationship between the rotor and stator parts.

A secondary governor valve from the admission port provides for admitting high-pressure steam directly to the second expansion stage when the turbine is to carry heavy overloads or if the vacuum fails from any cause. Frictionless glands at the ends of the stator prevent the admission of air or the escape of steam. The rotating balance pistons revolve within the stator with a close fit, but not in contact. The adjacent surfaces are provided with frictionless packing rings. These offer a devious path for the steam, and leakage past them is inappreciable.

A port in the stator serves to equalize the pressures between the stage chambers. The stator is divided on a horizontal plane. By lifting the upper part, as shown in Fig. 1, the whole interior of the turbine is exposed for inspection. The lower part rests upon pedestals or feet cast upon it at either end. One of these pedestals is bolted to the bed plate, the other being free to move as the cylinder expands or contracts and slides between machined ways on the bed plate.

In turbines of moderate sizes, the bearings consist of a nest of loosely fitting metallic sleeves which hold between them oil drawn in by capillary attraction. These films of oil form liquid cushions which restrain vibration while allowing the shaft to revolve upon its gravity axis. The bearing surfaces are sufficient in size to render high-pressure lubrication unnecessary, and wear is inappreciable. A turbine bearing is shown in Fig. 3.

The annular volume between the rotor and stator gradually increases from the inlet to the exhaust. To provide for this the blades are gradually increased in length from ring to ring. When a mechanical limit to this is reached the diameter of the rotor is abruptly increased and a new stage begun.

Clearances between adjacent rings of blades vary from ⅛ inch to 1 inch, increasing from the inlet to the exhaust. These variations in clearances do not affect the steam economy. The low steam velocity completely protects the blades from wear. The steam thrust on each blade is equal to about one ounce avoirdupois, which is far within the bending strength of the metal. A rigid shaft and thrust block adjustment accurately preserves the clearances.

Regulation is accomplished by means of a constantly moving pilot valve controlled by a fly-ball governor, shown in Figs. 4, 5 and 6. The governor levers are mounted on knife edges instead of pins to secure sensitiveness. Speed may be regulated while the governor is in motion. This is particularly useful for synchronizing the speed of alternating-current machines operated in parallel and for adjusting their differences of load when so operated.

The pilot valve controls the admission valves, which are of the balanced vertical lift poppet type. Steam is admitted to the turbine in puffs. High-pressure steam is admitted at all loads and the admission steam is not throttled in proportion to the load. At full load the steam puffs merge into an almost continuous flow.

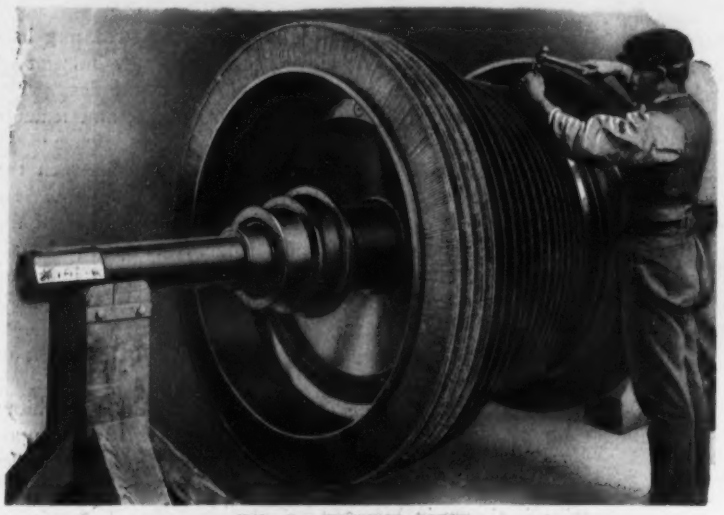


FIG. 2.—TURBINE ROTOR.

FIG. 3.—TURBINE BEARING.

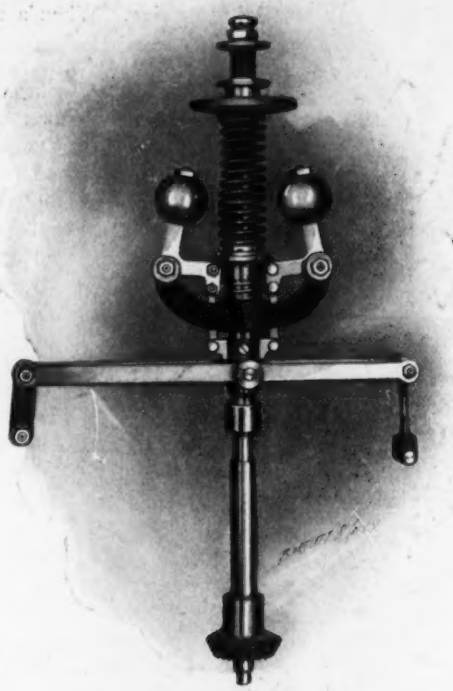


FIG. 4.—GOVERNOR.

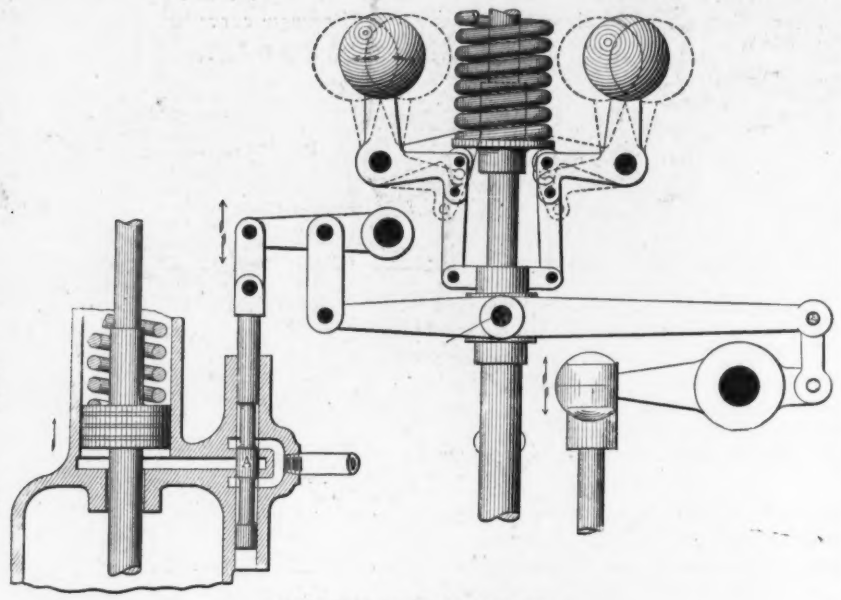


FIG. 5.—DETAILS OF GOVERNOR.

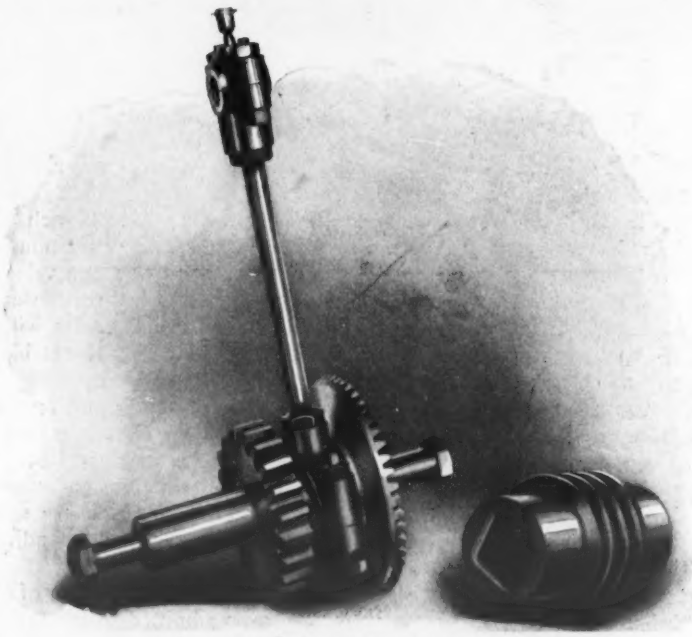


FIG. 6.—GOVERNOR DRIVE.

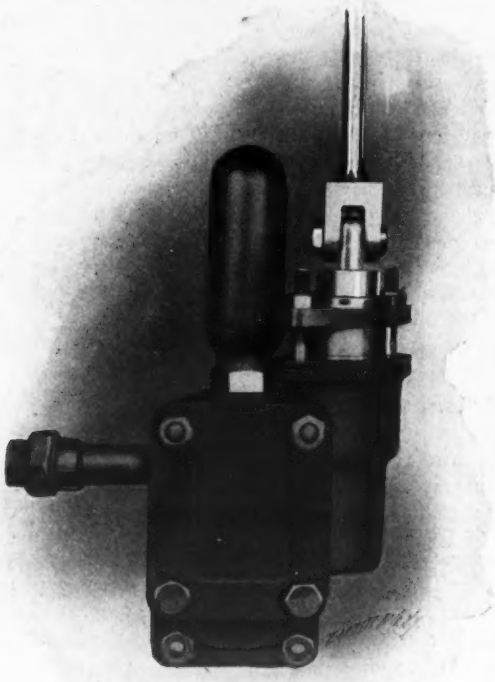


FIG. 7.—OIL PUMP.

The governor and pilot valve are operated by a worm gearing on the main shaft, shown in Fig. 5. The pilot valve has no "inertia of rest," and does not stick. On the larger machines a speed limit governor is arranged to instantly shut off the steam supply whenever a predetermined limit of speed above normal is reached.

Oil for the turbine and generator bearings is raised by a small plunger pump, Fig. 7, from a main reservoir in the bed plate and circulates by gravity, being cooled by water coils. No oil under high pressure is used in this type of turbine.

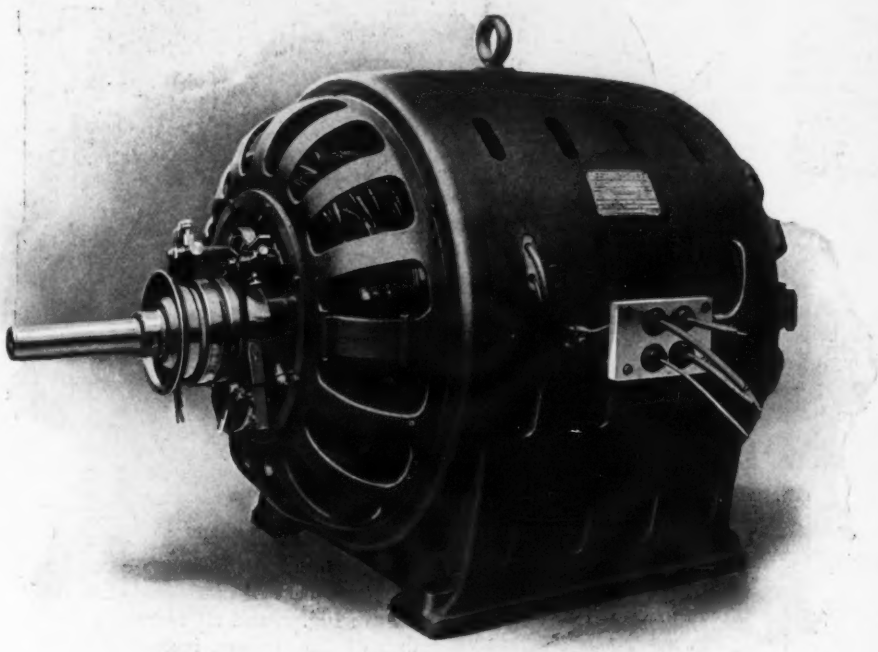


FIG. 8.—400-KW ALTERNATING-CURRENT TURBO-GENERATOR.

For the generators, two frequencies are now standard: 25 cycles per second for railway and power work and 60 cycles per second for lighting. The generator characteristics determine the speed of the turbine units; for instance, the 25-cycle generator which at 1,500 r.p.m. has two poles, has four poles at 750 r.p.m. Fig. 8 shows a generator of 400-kw capacity.

The turbine generator has a revolving field, small in diameter and finished smooth to minimize windage. Ventilation is secured by ducts cut in the solid steel. The standard construction of laminated armature is employed and the structure is well ventilated by air ducts between the laminations, communicating with the exterior through openings in the frame. Bar, strap or wire windings are used according to the voltage and capacity of the machine, and through protection afforded by embedding them in closed slots in the laminations.

## The Frost Storage Battery Grid.

On April 12 last there was granted to Mr. George W. Frost, of Columbus, Ohio, a patent on a storage battery grid which merits special attention on account of the unusual design. The accompanying illustration, Fig. 1, will serve in a way to convey the idea embodied in the construction. The cut shows a section of the plate with one side sawed away, in order that the cross-section may be made clear. It would seem that it is practically impossible for the paste or active material to wear away or be forced out of a grid of a type similar to that in the illustration, as the T-shaped cross-section securely holds the paste in place. The paste is forced in while in a plastic condition and afterwards properly hardened and formed.

The grid is cast all in one piece in a two-part metal mould. The retaining strips are cast as thin as practicable, the usual thickness being .06 of an inch. This thickness is greater than is required to give the grid the necessary rigidity, and the cast grids are, therefore, passed under a broad milling cutter, which removes .03 of an inch from each side of the plate. The thickness of the cast grid, which is usually .32 of an inch for heavy stationary cells, is thereby reduced to .26 of an inch, the weight of the grid being decreased about one-third. For automobile batteries the grids are cast .25 of an inch thick and milled down to .19 of an inch. As the milling cutter passes over the surface of the plate it leaves narrow burrs or flanges at the edges of the retaining strips and webs. These flanges are of service in retaining the active material in the grid.

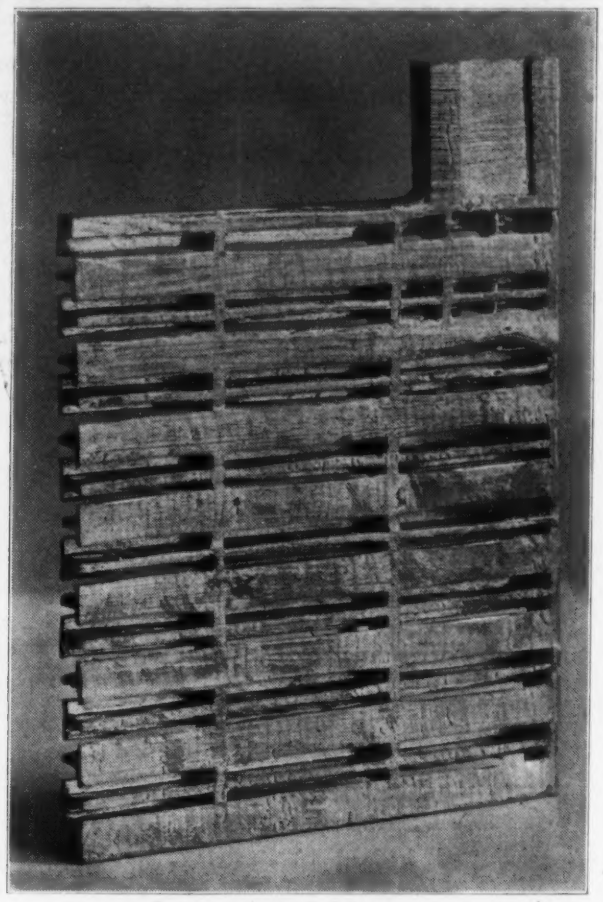


FIG. 1.—BATTERY GRID.

All grids are stiffened by several vertical ribs extending from the top to the bottom of the plate. The distribution of the metal of the grid is such as to give it great rigidity, with the least possible weight. The space available for active material amounts to from 50 to 70 per cent. of the total volume of the electrode, and the weight of active material, in portable batteries, may be 50 per cent. of the total weight of the electrode. The exposed surface of the active material is reduced to a minimum of about 40 per cent. of the total surface of the electrode, and the lead surface of the grid increases greatly the capacity of the plate as it becomes oxidized during use.

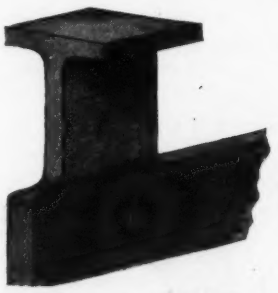


FIG. 2.—PLATE HEAD.

Careful tests have shown that the exposed surface of the active material is sufficient to give ready access to the electrolyte. For example, two cells were placed in series; one of them of 120 amp.-hours capacity of an approved standard design, the other of a similar capacity, but having plates of the design illustrated. A charging current was passed through them so that they received a total of 100 amp.-hours, or, in other words, they were purposely not quite completely charged. The standard type of cell was allowed to discharge its current through a fixed resistance, the output being 86 amp.-hours. Immediately thereafter the new type cell was made to discharge its current through the same resistance, the output being 87 amp.-hours, thus proving that the construction is such that the current is readily absorbed and given out.

The retaining strips and webs not only prevent the plate from buckling, but give a large contact surface, so that current is readily

carried to or taken from the active material. The design of the grid is also such that it expands very evenly as the active material increases in volume. The grid can be cast in a simple and inexpensive mould and a workman can cast several hundred medium-sized grids in a day.

Fig. 2 illustrates a T-shaped head, which is cast integral with the plates, and Fig. 3 shows how the plates are lined up ready to

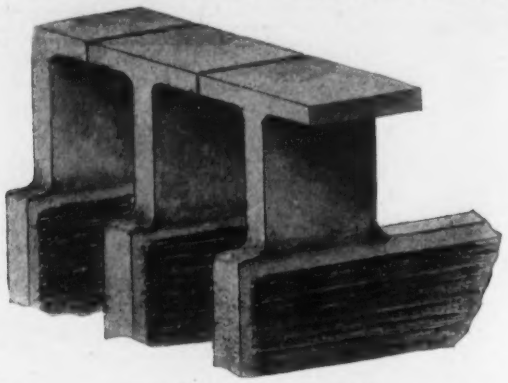


FIG. 3.—PLATES LINED UP.

be burned together with an oxyhydrogen flame; a mould being placed around the joint and the lead melted all the way through so as to produce an absolutely perfect joint.

The Frost grid has been adopted by the Columbus, O., Storage Battery Company as their standard for plate construction, and they have already installed several large lighting plant batteries, with plates of the new design.

## Indiana State Independent Telephone Convention.

The annual meeting of the Indiana Independent Mutual Telephone Association will be held in the City of Lafayette, Ind., June 28 and 29. There will be able papers prepared and discussions upon topics of vital interest to all independent telephone people. The leading manufacturers and supply men will make creditable displays of all lines of goods. The headquarters will be at the Hotel Lahr. There will be a programme of entertainment such as trolley rides, vaudeville shows, music, an inspection of the electrical and mechanical department of Purdue University, banquet and a dance, all of which will be free gratis to the members attending the telephone association. The Sterling Electric Company, of Lafayette, have also sent out a warm open-handed welcome.

## Theatre Dimmers.

It is a far cry from the earliest theatre dimmer consisting of incandescent lamps or iron wire mounted on a wood frame with crude circuit arrangements, to the thoroughly organized apparatus of today with their refinement of electrical design and excellence of mechanical execution. This is well illustrated in a new type of dimmer being placed upon the market by the Cutler-Hammer Manufacturing Company, several illustrations of which are given herewith. This new type is designed to meet the best requirements of stage lighting, which involve subdividing the lamps into a comparatively large number of circuits, thereby assuring more perfect control of the lighting and enabling special effects to be better obtained. In the dimmer illustrated, known as the "Simplicity" type, each unit or plate has a maximum capacity for 50 16-cp lamps, which number most nearly meets the average conditions for good stage lighting effects. As will be noted from the illustration, the dimmer units consist of circular plates mounted on an open frame, to which they are fastened by screws passing through three lugs into wrought-iron connecting bars. One of the features of this new type is the ease

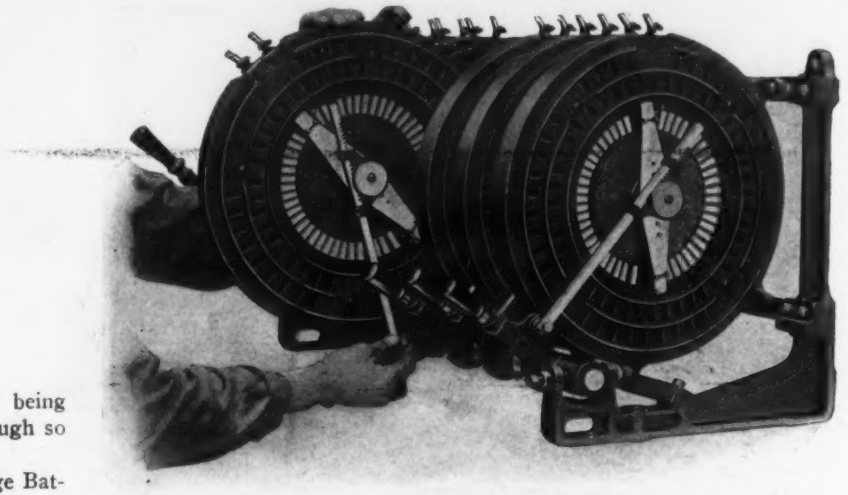


FIG. 2.—THEATRE DIMMER.

with which a section may be removed, which operation is indicated in Fig. 2. It is merely necessary to remove a pin from the operating lever and the three screws above mentioned, when the plate can be lifted out. The several plates consist of a base of insulating material carrying the contact parts, as shown in Fig. 2, and all current-carrying parts essential to the operation of the dimmer, including lever contacts, resistance and binding posts, are mounted on this one insulating base and form a complete rheostat in themselves. The plate is enclosed by the gridiron casting shown in the illustration, this simply forming a cover and finish and carrying the lugs whereby the plate is secured to the frame. The several levers connected with the rheostat rack arm are loose on an interlocking shaft and may be moved without reference to the position of the master lever. A slotted cam, Fig. 3, is placed at the side of the lever and fixed to the shaft with set screws so as to be moved when the shaft is moved. This cam is provided with a slot into which the interlocking bolt drops, and is so arranged that if dropped when the slot is not directly below, the bolt will rest on the curved surface of the cam and drop into the slot when the cam is moved into the proper position. By this arrangement a dimmer plate may be set at any desired point independent of the master lever, and may be picked up by the master lever when it reaches the corresponding position. The dimmers may have the operating handles mounted on the frame, as in Fig. 1, or mounted on a board in front, the dimmer being provided with rack extensions sufficiently long to pass through the board and be attached to the operating levers.

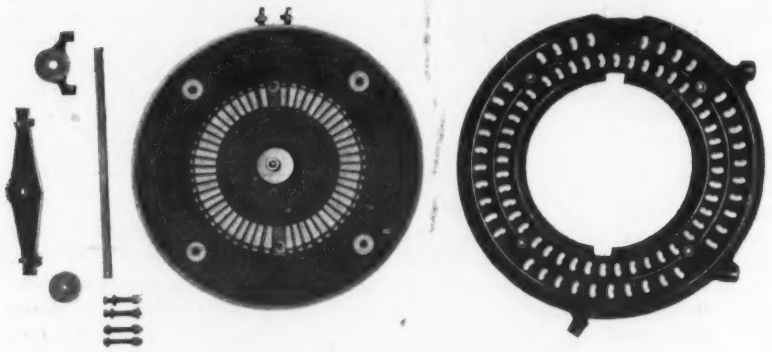


FIG. 1.—DETAILS OF DIMMER.

FIG. 3.—DETAILS OF LEVER.

# NEWS OF THE WEEK.

## Financial Intelligence.

THE WEEK IN WALL STREET.—Exceeding dullness prevailed in the market, which was entirely professional, the interest shown by the public being confined to the purchase of bonds. The United States Steel stocks were weak on the dissolution of the conversion syndicate and adverse trade reports, but their decline was checked on short covering. There also seemed to be nervousness on the part of the bears in the standard railroad stocks, owing to easy conditions in money and the attending lack of liquidation. Among the industrials, apart from the decline in Steel common and preferred and in the 5 per cent. bonds, there was little worthy of note. United States Rubber attracted some attention on account of the firmness of both the common and the preferred, following the resumption of dividends on the latter. A heavy tone prevailed in General Electric, due to threatened competition in the electrical manufacturing business. This stock closed at 158. Allis-Chalmers common was steady throughout the week, closing at 6½, which is unchanged from the previous quotation. Preferred stock closed at 41, which is a net gain of 2 points. Westinghouse common lost 3 points net, closing at 155, and preferred closed at 175, which is the same as the previous quotation. Bell Telephone remains practically unchanged, closing at 126; and the same applies to Western Union, which closed at 88⅞. Commercial Cable closed at 175. Among the tractions Brooklyn Rapid Transit was quite steady, closing at 45½, while Metropolitan Street Railway was somewhat weaker, closing at 108⅝, being a net loss of 1 point. Following are the closing quotations of March 10.

NEW YORK.

| | May 3 | May 10 | | May 3 | May 10 |
|---|---|---|---|---|---|
| Allis-Chalmers Co. | 6¼ | 6¼ | Electric Vehicle | 5¾ | 5⅝ |
| Allis-Chalmers Co. pfd. | 39 | 41 | Electric Vehicle pfd. | 9 | 9 |
| American Tel. & Cable | 86 | 86 | General Electric | 157½ | 157 |
| American Tel. & Tel. | 126 | 126 | Hudson River Tel. | .. | .. |
| American Dist. Tel | 23 | 22 | Metropolitan St. Ry. | 109¾ | 109 |
| Brooklyn Rapid Transit | 45⅝ | 45⅝ | N. Y. & N. J. Tel. | .. | .. |
| Commercial Cable | 175 | 180 | Marconi Tel | .. | .. |
| Electric Boat | 25 | 26 | Western Union Tel. | 88¼ | 89 |
| Electric Boat pfd | 60 | 60 | Westinghouse com. | 153¾ | 155 |
| Electric Lead Reduction | ⅝ | ¾ | Westinghouse pfd. | 175 | 175 |

BOSTON.

| | May 3 | May 10 | | May 3 | May 10 |
|---|---|---|---|---|---|
| American Tel. & Tel | 126¼ | 126¼ | Western Tel. & Tel. pfd. | 77 | 77 |
| Cumberland Telephone | 113½ | 113¼ | Mexican Telephone | 1⅜ | 1¼ |
| Edison Elec. Illum | 238 | *235 | New England Telephone | *122½ | *122½ |
| General Electric | 156¼ | 157 | Mass. Elec. Ry. | 19¼ | 18¼ |
| Western Tel. & Tel. | 8 | 8 | Mass. Elec. Ry. pfd. | 72¾ | 71¾ |

PHILADELPHIA.

| | May 3 | May 10 | | May 3 | May 10 |
|---|---|---|---|---|---|
| American Railways | 44 | 44 | Phila. Traction | 96 | 96 |
| Elec. Storage Battery | 57 | 56 | Phila. Electric | 5¼ | 5¼ |
| Elec. Storage Battery pfd. | 57 | 56 | Phila. Rapid Trans. | 13¼ | 13¾ |
| Elec. Co. of America. | 7⅛ | 8 | | | |

CHICAGO

| | May 3 | May 10 | | May 3 | May 10 |
|---|---|---|---|---|---|
| Central Union Tel. | .. | .. | National Carbon pfd. | 103 | 103¼ |
| Chicago Edison | .. | .. | Metropolitan Elev. com. | 15 | 15 |
| Chicago City Ry. | 158 | 155 | Union Traction | 5⅛ | 5¼ |
| Chicago Tel. Co. | .. | .. | Union Traction pfd. | 30¼ | 30 |
| National Carbon | 30 | 28 | | | |

*Asked

CONSOLIDATION OF ROCHESTER ELECTRICAL INTERESTS.—Official announcement of the plans of the merger of the Rochester Gas & Electric Company, the Rochester Railway Company and the Rochester Light & Power Company has been made. The name of the consolidated company is to be the Rochester Railway & Light Company and its capital stock will be $3,000,000 of preferred stock and $6,500,000 of common. The issue of the first consolidated mortgage 5 per cent. bonds not to exceed $16,000,000 will be authorized and used to retire the present funded debt of the Rochester Gas & Electric Company. Provision has been made for the sale of $500,000 of these bonds at par, an accrued interest balance to be reserved for the requirements of the consolidated company. Under the provision of the consolidation a balance of about $1,200,000 in cash will be immediately available for the company's purposes, and from further assessments on the common stock and from surplus earnings it is estimated that another $1,000,000 will be forthcoming for betterments, extensions and improvements during the years 1904, 1905 and 1906. In addition to this amount, there will be in the hands of the trustee $4,073,000 of bonds reserved for future requirements.

THE MACKAY COMPANIES.—A director of the Mackay Companies makes the following statement to the *Wall Street Journal* of the amount of the stocks of the companies now held in Canada: "While five years ago fully one-half of the stock of the present Mackay Companies was held in Canada, at the present time not more than one-third of the stock at the very most is held here. It is held by between 400 and 500 people living in different parts of Canada, all the way from the Atlantic to the Pacific. Unlike most stocks, it is nearly all held for investment and I do not think there are 500 shares held by Canadians that could be secured in the open market. We are all satisfied with the plan that is being carried out by President Mackay."

SAN FRANCISCO TROLLEYS.—The United Railroads of San Francisco reports as follows for the year ended December 31:

| | 1903. | 1902. | 1901. |
|---|---|---|---|
| Gross | $6,243,219 | $5,533,904 | $5,125,883 |
| Expenses and taxes | 3,910,835 | 3,274,129 | 3,059,958 |
| Net | $2,332,384 | $2,259,775 | $2,065,925 |
| Other income | 24,754 | 28,906 | 17,230 |
| Total income | $2,357,138 | $2,288,681 | $2,083,155 |
| Charges | 1,536,438 | 1,324,050 | 723,200 |
| Balance | $820,700 | $964,631 | $1,359,955 |
| Sinking funds | 123,999 | 114,000 | 84,000 |
| Balance | $696,701 | $850,631 | $1,275,955 |
| Dividends | 480,000 | | |
| Surplus for year | $216,701 | | |

An allowance of $157,500 for depreciation leaves $59,201 for profit and loss surplus.

CINCINNATI GAS AND ELECTRIC.—The earnings of the Cincinnati Gas & Electric Company for the year were $1,397,000 net, or 4.80 per cent. on the total capital, slightly over $29,000,000. It is expected that during the current year the earnings will aggregate $1,605,000, that for 1906 they will be $1,845,000, in 1907 $2,120,000, and in 1908 $2,436,000. The company now has 4,789 stockholders, against 4,300 last year. After deducting dividends of 4 per cent. for the year there is a surplus of $43,000.

INCREASE IN GENERAL ELECTRIC'S CAPITAL.—The stockholders of the General Electric Company, at a special meeting in Schenectady, on May 10, voted favorably on the proposition to increase the company's capital $3,325,500, making the total capital $48,325,500. Immediately after this meeting the annual meeting of the company was held, at which the present board of directors was re-elected.

## Commercial Intelligence.

THE WEEK IN TRADE.—It is a pleasure to note the change in tone of trade reports as compared with the discouraging records of the past few weeks. The long-looked-for good weather has at last materialized, and agriculture and trade have taken on a seasonable aspect in consequence. Farmers are helped by it and crop preparations and planting have made good progress. Retail and wholesale trades, while improved, are not so strong as they should be, and the results are rather under the earlier expectations. Reorder trade with jobbers, as noted by one of the mercantile agencies, is slow and fall orders are backward. Other conditions, it is pointed out, partake of irregularity. Iron is quieter, and prices are weaker. On the other hand, the labor situation is more settled and favorable as compared with that of last year at this season. Pig iron is easy in price in all markets, with limited sales, aside from the placing of contracts for castings for new railway construction work. Finished products are dull and unsettled. Copper also tends downward on enlarged production and less eager demand. Business was on a very limited scale, and the export movement was much below the level of earlier months. The market closed steady but dull at the following prices: Lake, ⅜c. to 13⅝c.; electrolytic, 13⅛c. to 13¼c.; casting stock, 12⅞c. to 13⅛c. The exports of copper for April aggregated 13,567 tons, this being a heavy falling off as compared with previous months of the year. Railway earnings continue to decline. Failures, *Bradstreet's* states, are slightly above the normal in number, but, swelled by suspensions of financial institutions and a few large manufacturers, liabilities are heavy for this season of the year. The number of failures reported by the same authority, for the week ending May 5, was 176, against 188 the previous week and 175 the corresponding week last year.

SOME C. & C. ORDERS.—The C. & C. Electric Company, 143 Liberty Street, New York, has secured a contract for a 150-kw generator, together with six motors aggregating 200 hp for installation in large saw mills operated by A. A. Low, of Brooklyn, brother of Seth Low, in St. Lawrence County, Adirondacks. The plant will be operated by water. The Aetna (Ind.) Powder Company, whose

plant is already equipped with 220 kw of C. & C. generators, has just ordered 75 hp of motors. The Arkelyan Press, Boston, Mass., has ordered a 30-hp series-parallel equipment to be utilized to operate a Hoe magazine press and a 35-hp outfit is to be shipped to the Seattle (Wash.) *Post-Intelligencer* for driving a Hoe quadruple press. The latter order is a duplicate of one secured three years ago. Another repeat order comes from the Ohio Quarries Company for two 50-hp motors to be used for operating grindstone lathes at the North Amherst quarries of the company. The St. Paul Roofing & Cornice Company, of Baltimore, is to be shipped four small motors for driving machine tools. Two 50-kw generators have been ordered by John R. Sheehan & Co., the building contractors, for the Gouverneur Hospital, to be used for lighting purposes. The engineering firm of Reis & O'Donovan, 15 Cortlandt Street, has ordered a 20-kw direct-connected generator and five motors aggregating 50 hp for operating equipment in the Manual Training High School. The St. Charles (Ill.) Home for Boys is to have two C. & C. direct-connected generators of 50-kw capacity each. This equipment will be used for both light and power. The C. & C. people also report receipt of a fair number of small orders for motors and generators for export to Canada, Cuba and Mexico.

GERMAN TELEPHONE SYSTEM.—Mr. Richard Guenther, United States Consul-General at Frankfort, Germany, states that the total cost of the German federal telephone system, operated in connection with the German federal telegraph system, is $60,000,000 up to date. The kingdoms of Bavaria and Württemberg are not included, these having their own independent telephone systems. The longest telephone connection in Germany is the one between Berlin and Paris, 742 miles. Next is Berlin and Budapest, 612 miles; Berlin and Memel, 593 miles; Berlin and Basel, 577 miles. The following connections are all more than 300 miles long: Berlin with Dortmund, Düsseldorf, Essen, Frankfort, Gleiwitz, Cologne, Königsberg, Munich and Vienna; Hamburg with Copenhagen; Frankfort with Paris and Hamburg. The line between Berlin and Frankfort is the most used—485 communications daily. The number between Berlin and Cologne is 243; Berlin and Vienna, 118, and Berlin and Düsseldorf, 116. In spite of the high fee not less than 65 communications daily take place between Berlin and Paris.

MANUFACTURING IN IOWA.—The Black Hawk Electric Company is the latest addition to the business concerns incorporated at Davenport, Iowa. The articles of incorporation show the new company to be composed of W. A. Fuller, James E. Bayliss and John H. Eagal. Mr. Fuller is the well-known electrician at the Rock Island arsenal and Messrs. Bayliss and Eagal have been in partnership for some time in Davenport in the automobile business. Mr. Fuller was originally with the General Electric Company for many years. The capital stock of the new company is $10,000 and the general nature of its business is to manufacture, contract and install electrical power and lighting plants, the sale, manufacture and installation of all electrical appliances, apparatus and sundries, mechanical, electrical and hydraulic engineering, and the selling, repairing and renting of automobiles. The officers and directors of the company are as follows: President, W. A. Fuller; vice-president, James E. Bayliss; secretary and treasurer, John H. Eagal.

THE GREGORY ELECTRIC COMPANY, of Chicago, reports among recent orders the sale of a direct-connected, 75-kw, two-phase, 60-cycle Westinghouse alternating generator to W. A. McKay & Co., Sydney, C. B., Canada; two 120-kw Westinghouse alternators to the Fulton Electric Light & Power Company, Fulton, Ky.; a 120-kw General Electric alternator to the Stanberry Electric Light & Power Company, Stanberry, Mo.; a 37½-kw Fort Wayne alternator to the Madeline Electric Company, Madeline, Cal., besides a large number of direct-current generators and motors. Their spring business is exceptionally good, sales being slightly in advance for the corresponding time of last year. The Gregory Company reports an unusual amount of repair work on hand at the present time in its repair department. The force in this department is now larger than ever before in the history of this company.

TURBINES FOR BRIDGEPORT FACTORY.—The Eaton, Cole & Burnham Works at Bridgeport, Conn., are to be operated by an electric plant, which will be one of the most elaborate and extensive equipments ever installed by an Eastern manufacturing concern. The electrical machinery will ultimately be capable of generating 2,400 kw. Westinghouse turbines will be put in while both the Westinghouse and General Electric Companies have secured orders for motors. The turbines, two of which have already been contracted for, will be 400 kw each. The motors, aggregating over 600 hp and ranging from 3½ hp to 30 hp, will be built by the General Electric and Westinghouse people—about 300 hp each. The switchboard, consisting of a combined generator, exciter and thirteen feeder panels, will be of Westinghouse build. G. K. Hooper, Bowling Green Building, is consulting engineer in the matter.

ELECTRICITY FOR COTTON SEED OIL PLANT.—The Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, has secured a contract for the first electrical equipment to be used in this country for operating a cotton seed oil mill. The mill will be built at Sinclair, La., for George H. Laws, of Cincinnati, Ohio, and will have a capacity of 60 tons per day. It will be driven by six motors aggregating 305 hp and varying from 5 hp to 75 hp. There will be two of 75 hp, three of 50 hp and one of 5 hp. The motors will be General Electric alternating-current, three-phase, 60-cycle, 550-volt type.

EQUIPMENT FOR NEW TIFFANY STORE.—The new $1,000,000 Tiffany Building, at Thirty-seventh Street and Fifth Avenue, New York City, is to be equipped with a 275-kw electric plant. There will be three units. The engines will be built by the Ames Iron Works, of Oswego, N. Y. The generators will be Westinghouse. The wiring will be done by Livingston Johnston, Jr., & Co., 113 East Twenty-second Street. The H. Krantz Manufacturing Company, of Brooklyn, took the order for the switchboard. C. O. Mailloux, 76 William Street, is the consulting engineer on the electrical work.

MOTORS FOR COAST FORTIFICATIONS.—The U. S. war department has placed a contract with the Holtzer-Cabot Electric Company, of Brookline, Mass., for a large lot of special motors to be used for the manipulation of disappearing gun carriages in the various fortifications along the Atlantic coast. The machines will be multipolar motors. Sixty motors have already been ordered of 4 hp. capacity, each operating at 400 r.p.m.

EQUIPMENT FOR ABRAHAM & STRAUSS.—Additional lighting equipment is to be installed in the Abraham & Strauss department store, Brooklyn. The outfit will comprise a 400 kw direct-current generator to be direct connected to a 600 hp Corliss engine. Mr. C. O. Mailloux, 76 William Street, is the consulting engineer in the matter. The existing equipment is of 800 hp capacity and has been installed for several years.

ALBERGER CONDENSERS FOR PHILA. R. T. PLANT.—The Alberger Condenser Company, White Building, has secured the contract for the condensing equipment for the Philadelphia Rapid Transit Company's plant. Jet condensers of dry vacuum system with centrifugal circulating pumps and Corliss two-stage dry vacuum pumps capable to taking care of four 1500-kw Westinghouse turbo-generators, will be installed.

TWENTY-THIRD REGIMENT ARMORY CONTRACT.—The lowest bidders on the lighting equipment to be installed in the Twenty-third Regiment Armory, Brooklyn, are Peet, McAnerney & Powers, 225 Fourth Avenue, New York. The capacity will be 185 kw., two 75 kw., and one 35 kw. generators have been requisitioned for. Mackenzie, Quarrier & Ferguson are the consulting engineers.

EQUIPMENT FOR WANAMAKER PLANT.—The John A. Roebling's Sons Company, 117 Liberty Street, has obtained the contract for the wire to be installed in the huge new Wanamaker store, New York, whose electric plant, as stated in our last issue, will have a capacity of 1800 kw. and will have Westinghouse generators and Buckeye engines—six units. The Thompson-Starrett Company is letting the contract.

EQUIPMENT FOR MEXICAN MINES.—An American syndicate in which William M. McCord and Lucien M. Fairbanks, of Chicago, are largely concerned, will very shortly be in the market for electrical equipment intended to operate large mills on its Peregrino mines in the Guadalajara district, Mexico. The properties have been recently acquired by the syndicate from the Gonzales family.

CUTTER CIRCUIT-BREAKERS FOR BRITISH NAVY.—The Cutter Company, of Philadelphia, whose Mr. Scott is now on the other side regarding the matter, has just secured a substantial contract from the British Admiralty for circuit-breakers for navy use. The company has also been allotted a contract for large circuit-breakers by the Philadelphia Rapid Transit Company.

TELEGRAPH WIRE FOR NICARAGUA.—The American Steel & Wire Company has received a contract for wire to be used in the construction of several hundred miles of telegraph lines in Nicaragua. These lines will be built by the United States & Nicaragua Company, a $10,000,000 concern in which prominent Pittsburgers are chiefly interested.

ALLIS-CHALMERS-BULLOCK.—The Canadian businese of the Allis-Chalmers Company, which recently acquired the Bullock Electric Manufacturing Company, of Cincinnati, will herafter be conducted by a new organization bearing the name Allis-Chalmers-Bullock, Ltd. The works and principal offies of this important new Canadian company are in Montreal.

BIG EQUIPMENT FOR GRAPHIC ARTS BUILDING.—Considerable electrical equipment is to be installed in the Graphic Arts Building, to be built by the *Town Topics*. Walter Tubby, the architect, of 80 Fulton Street, has the matter in hand.

# General News.

## THE TELEPHONE.

FLORENCE, ALA.—The Bell Telephone Company will build a line from Florence to Bailey Springs. Five thousand dollars will be expended in improvements.

DUNCAN, ARIZ.—A new telephone line is to be constructed from this place to Guthrie. The line will connect at Guthrie with the Gila Valley Telephone Company's line which will give Duncan direct communication with the towns of Clifton and Morenci.

TEXARKANA, ARK.—The New Long Distance Telephone Company, of this city, has opened its line from this city to Honey Grove, Tex., a distance of 100 miles. It is stated that a line will be built from Texarkana to Little Rock.

SANTA ROSA, CAL.—The Mark West & Santa Rosa Telephone Company has been organized here with R. Peterson as president and J. M. Laughlin, as secretary.

MONROVIA, CAL.—The Monrovia Telephone & Telegraph Company's system has been sold to Boaz Duncan, W. W. Wollwine and Dr. West Hughes, of Los Angeles.

LOS ANGELES, CAL.—Sealed bids will be received until May 23 by C. G. Keyes, county clerk, for a franchise to construct and maintain for a period of 30 years telephone lines throughout the streets and highways of the County of Los Angeles. Conduits and pole line will be used.

SAN BERNARDINO, CAL.—The United States Long Distance Telephone Company has filed articles of incorporation with the county clerk. The principal place of business is Los Angeles and the capital stock is $3,000,000. The directors are C. A. Gates, A. F. Morlan, D. J. Maguire, et al.

TAYLORVILLE, ILL.—The Interstate Telephone Company has decided to establish an exchange here.

HARDIN, ILL.—The Calhoun Telephone Company has increased its capital stock from $15,000 to $25,000.

MILLSTADT, ILL.—Permission has been granted to the Millstadt Telephone Company to build and operate a telephone line in this village.

EVANSVILLE, ILL.—The Evansville Telephone Company has been incorporated with a capital stock of $2500. The incorporators are William Wolff, John V. Tummel and William R. Mathews.

CHICAGO, ILL.—The charter of the United Telegraph & Telephone Company has been filed with the county recorder. The capital stock of the company is $2500, and the names of the incorporators are Henry E. Weaver, G. Watson French, Henry L. Turner, Harry D. Critchfield and Harry Rubens.

ALEXANDRIA, IND.—The Central Union Telephone Company is arranging to install an entirely new system in this city.

LEISURE, IND.—The Leisure Telephone Company has been incorporated with a capital stock of $10,500. The directors are Arthur L. Hiatt, David T. Hutcherson, David S. Wasdwell, Frank Smith and William Steel.

MECHANICSVILLE, MD.—The Southern Maryland Telephone Company which was incorporated by the last legislature has been organized with the following officers: J. F. Coad, president; L. J. Canter, vice-president; J. B. Ballenger, secretary-treasurer; J. L. Sothoron, recording secretary. A line has already been built by the company between Mechanicsville and Charlotte.

CEDAR FALLS, IA.—The Cedar Falls Mutual Telephone Company has been incorporated.

PLYMOUTH, IA.—The Plymouth Telephone Company has been incorporated with a capital stock of $10,000.

CONESVILLE, IA.—The Conesville Telephone Company has been incorporated with a capital stock of $10,000.

SANBORN, IA.—The Floyd Valley Rural Telephone Company, of Sanborn, has been incorporated with a capital stock of $1000. The incorporators are N. S. Miller, P. H. Miller, Wm. Clarksen, George Dummett, J. H. Greet and J. J. Getting.

OLATHE, KAN.—The Olathe Citizens Telephone Company has been sold to Oscar Ayers, of Gardner, for $20,000. Mr. Ayers is also proprietor of the Gardner Telephone Company. The connections are to be made with the Home Telephone Company of Kansas City within the next 30 days.

FLEMINGSBURG, KY.—The Flemingsburg Telephone Company has increased its capital stock from $25,000 to $35,000.

BOSTON, MASS.—A bill before the Legislature to put telephone and telegraph corporations under the supervision of the Gas and Electric Light Commission of this state was defeated by a tie vote a few days ago, on the third reading.

QUINCY, MICH.—The Michigan State Telephone Company has ordered material for the construction of 115 miles of lines in Branch County.

BEAVER CREEK, MINN.—A local telephone company is projected in this place. Mr. O. M. Page is president.

WHITE BEAR, MINN.—The Twin City Telephone Company has been granted a franchise for an exchange in this place.

SHAKOPEE, MINN.—C. Kopp, C. T. Buchanon and G. H. Reis have been granted a franchise to construct and operate a telephone exchange here.

HOLUM, MINN.—The Sunberg & Brooten Telephone Company will build a two-wire line between the two points named, the distance being 25 miles.

CHAPMAN, NEB.—The Chapman Telephone Association of Chapman has been incorporated with a capital stock of $50,000. This will be an independent system.

TROY, N. Y.—The Cooperstown, Cherry Valley & Sharon Springs Telephone Company has increased its capital stock from $5000 to $10,000.

SYRACUSE, N. Y.—Mr. Frank M. Potter, Jr., general superintendent of the Syracuse Telephone Company, is inspecting the automatic telephone systems in use in some Western cities, and if he believes such a system is feasible for Syracuse it will be installed here.

MIDDLETOWN, N. Y.—The Hudson River Telephone Company has purchased a lot in this city on which it will erect an office building. The new exchange will be fire-proof and will be used exclusively by the company. It is the intention of the company to lay conduit throughout the principal streets and remove its overhead wires.

RAVENA, N. Y.—The Ravena & Medway Telephone Company has been incorporated with a capital stock of $5000. The directors are William C. Harden and Ernest Bilz, of Stanton Hill; Harry Thorne, New Baltimore; Clifton Bedell, Aquetuck; E. L. Haight, Arthur Hartt, Frederick C. Bush and Clarence E. Whitney, of Ravena; Harrie McK. Curtis, Coxackie.

FLUSHING, N. Y.—The New York & New Jersey Telephone Company announces that hereafter its local subscribers will have an unlimited local service and that the toll rates for calls to New York, Brooklyn and Long Island City will probably be considerably reduced in the near future. This action on the part of the company is claimed to be the result of the agitation by the Flushing Association for lower rates.

SYRACUSE, N. Y.—One million dollars will be expended in the extension and improvement of the systems of the Central New York and the Empire State Telephone & Telegraph Companies. The bulk of the appropriation will be expended in the city of Syracuse and vicinity. A new five-story exchange building will be erected in this city at a cost of $200,000. The new switchboard which will cost $150,000 will have a capacity for 20,000 lines.

RALEIGH, N. C.—The Ivey Telephone & Telegraph Company, of Mars Hill and Marshall, Madison County, has been incorporated with a capital stock of $125,000.

MIDDLEBURG, PA.—The Snyder County Rural Telephone Company has been organized by the election of Alfred Schloch as president and J. M. Baker, secretary. This company has been organized to take the place of the United Telegraph & Telephone Company.

PORT ROYAL, TENN.—The Cumberland Telephone Company has established an exchange at Port Royal, Tenn.

CUERO, TEX.—A telephone line is being constructed between this place and Cheapside.

PRINCETON, TEX.—The Princeton Telephone Company has increased its capital from $25,000 to $240,000.

TAYLOR, TEX.—The Williamson County Telephone Company will enlarge its system and make other improvements.

ROCKFORD, WASH.—The Rockford Telephone Company has been organized by C. S. Shepard as president; G. Saunders, vice-president, and O. Sullivan, secretary. The company will build a line from Mt. Hope to Rockford.

GLIDDEN, WIS.—The Glidden Telephone Company will build several farm lines during the summer.

## ELECTRIC LIGHT AND POWER.

SEWARD, ALASKA.—The Seward Electric Company has been incorporated by George E. Dickinson and George Sohus.

MENDOCINO, CAL.—The Mendocino Electric Light & Power Company has taken possession of the Mendocino Lighting Company's plant. The price paid for the old company's property was $15,000. The business has been re-organized, Mr. J. A. Grindle being elected president and Albert Brown, secretary.

SILVERTON, COL.—The town of Silverton contemplates building about two miles of new line for its electric light service and installing 25 series arc lamps.

WASHINGTON, D. C.—Bids will be received May 24 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the navy yards at Mare Island, Cal., and Puget Sound, Wash., a quantity of arc lamps, carbons, incandescent lamps, electric fans and exhausters, conduit and fittings, transformer, etc. Address H. T. B. Harris, Paymaster General, U. S. N.

WOOD RIVER, IDA.—The Idaho Electric Light Company is contemplating the installation of new machinery at this place and will greatly increase its plant.

GREER, IDA.—High water washed away the dam and flume of the Lolo Creek Power Company recently, entailing a loss of $10,000. The dam and flume were built on Lolo Creek at a cost of $25,000. The plant furnished electricity for a lighting plant and mills at Nez Perce. The damage will be repaired as early as possible.

LITCHFIELD, ILL.—The United Gas & Electric Company has been incorporated with a capital stock of $100,000. The incorporators are David David, William F. La Force and Jacob J. Frey.

OTTAWA, ILL.—The property of the Marseilles Water & Light Company has passed into the control of W. D. Boyce. The new board of directors chose the following-named officers: W. D. Boyce president; Benjamin Boyce vice-president; Dwight Cook, treasurer, and L. H. Strawn, secretary.

INDIANAPOLIS, IND.—The Union Trust Company, of this city, has been appointed receiver for the Home Heating & Light Company on the petition of Knight & Jellison Company. The complaint charges that Home Company is wholly insolvent. The plant will be operated by the receivers.

FT. THOMAS, KY.—Bids are wanted May 31 for wiring buildings, furnishing and installing watt and voltmeters, transformers, arc lamps, and other electric fixtures; erecting necessary pole lines on the reservation, and furnishing

necessary current for electric lighting at this post. Address Lieut.-Col. W. H. Miller, Ch. Q. M., Pullman Bldg., Chicago, Ill.

BATON ROUGE, LA.—The Capital Light & Power Company has been incorporated with a capital stock of $25,000. The names of the incorporators are C. H. Kretz, E. F. Wieck and Turner Buynum.

ANNAPOLIS, MD.—Bids will be received at the Navy Department, Washington, D. C., until May 21 for boilers, engines and dynamos at the U. S. Naval Academy, Annapolis. Address Chas. H. Darling, Assistant Secretary.

KALKASKA, MICH.—The Kalkaska Electric Light Plant, Saw & Planing Mill contemplates building a dam and installing a plant for the utilization of water power. It intends to change its present direct current system to alternating current.

ANN ARBOR, MICH.—The Michigan Milling Company has two water powers within five miles of Ann Arbor, which are likely to be utilized for electrical work in addition to the present water power plant of the company. Mr. N. J. Kyer is manager.

JANESVILLE, MINN.—The Council is considering plans for a system of water works and electric lighting, to cost $22,000.

MONTEVIDEO, MINN.—The Montevideo Electric Light & Power Company, of Montevideo, has been incorporated; capital, $60,000. Incorporators: E. H. Sorlien and Olaus Lende, Granite Falls; E. A. Aspines and Lyndon A. Smith, Montevideo.

GREENWOOD, MISS.—The citizens of Greenwood have voted to issue $125,000 worth of bonds in order to purchase the electric light plant, water works and sewerage plant.

WOODVILLE, MISS.—Bids will be received by the Mayor and the Board of Aldermen until June 7 for building a system of water works and an electric light plant. W. C. Miller is mayor; C. N. Jenks, Fayette, Miss., is the engineer.

ST. LOUIS, MO.—A $1,000,000 mortgage on the property of the West St. Louis Water, Light & Power Company in favor of the St. Louis Union Trust Company, trustee, was filed in the Recorder's office in Clayton, St. Louis County, April 20. One thousand $1000 20-year gold bonds are to be issued, 600 of which are to be placed on the market immediately.

JOPLIN, MO.—W. G. Sergeant, of Joplin, has begun the work of building a dam across Spring River, at Lowell, Kan. It is estimated that a 7200-hp will be available. An electric plant will be erected on the banks of the river, and power will be transmitted to all sections of the mining district. It will probably be a year before the plant is in operation.

ST. LOUIS, MO.—Plans for a municipal plant to light by electricity that portion of the city south of Keokuk Street are still being considered by the Board of Public Improvements. It was first planned to locate a plant on the river near Elwood Street, but the latest idea is to have it situated at the House of Refuge, Osage Street and Virginia Avenue. The board has not yet progressed far enough to state what the plant will cost. At present the city pays $59,000 per year for lighting the city south of Keokuk Street with gas.

LINCOLN, NEB.—The North Platte Electric Light & Power Company, of Colorado, has decided to do business in Nebraska. Articles of incorporation have been filed with the Secretary of State of Nebraska. The principal place of business is in Denver, and the capital stock is $20,000. The company operates its plants by power obtained from North Platte River.

MUNNSVILLE, N. Y.—The Stanley Electric Company and the Cramp's have completed estimates for the construction of a power plant of 1000-hp at Limekiln Falls, near Munnsville, at a total estimated cost of $45,000.

NEW YORK, N. Y.—The following are the bids opened April 23 by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for a turbo alternator, five induction motors, a generator and two switchboards and accessories: General Electric Co., $47,447 (with certain modifications); Westinghouse, Church, Kerr & Co., New York, N. Y., $54,000.

SALISBURY, N. C.—All the stock and securities, amounting to $50,000, belonging to the Salisbury Gas & Electric Light Company, have been transferred at par value to the Salisbury & Spencer Street Railway Company. H. B. McCanless is president, and H. Vanderford, secretary.

ANTELOPE, ORE.—The citizens are considering the question of constructing an electric light plant.

PORTLAND, ORE.—It is reported that the Portland General Electric Company will expend about $250,000 on an extension to its power plant.

BRADFORD, OHIO.—The Bradford Electric Light Company has been incorporated with a capital of $10,000 by A. W. McCune, G. Z. Arnold and others.

NEWTON FALLS, OHIO.—Bids will be received May 20 by the City Council for an electric light plant. The successful bidder will be given a contract for 10 years for lighting the village and a 20-year franchise for commercial lighting and furnishing power.

SHENANDOAH, PA.—Bids are wanted by the Borough Council for furnishing 60 or more street arc lights of 2000-cp.

CARBONDALE, PA.—The Hendrick Light & Power Company, of Carbondale, has been incorporated with a capital of $5000.

SPANGLER, PA.—The Spangler Electric Light, Heat & Power Company, of Spangler, has been incorporated, with a capital of $5000.

DANVILLE, PA.—The Council has voted to establish a municipal light plant and the Committee on Light has been instructed to procure estimates prior to asking for bids. H. B. Patton is borough secretary.

ANDERSON, S. C.—A company has been organized at Anderson, S. C., to develop the Hatton Shoals on the Tugaloo River. A large electric power plant will be built.

CALDWELL, TEX.—Cypher Bros., of Austin, propose constructing an electric light and ice plant here to cost about $10,000. D. A. Cypher is the engineer.

LEONARD, TEX.—The Leonard Electric Light & Ice Company has been organized to construct an electric light and ice plant. Y. T. Manning is president, L. H. Saunders, secretary.

CLARENDON, TEX.—The City Council has granted two franchises for the operation of electric light plants in Clarendon—one to Chase & Co., who have been for some time operating a plant in this city, while the other was granted to Jas. Trent, who will immediately install a plant.

HOUSTON, TEX.—The Houston Light & Power Company has been increasing the capacity of its plant and it is now ready for the installation of the machinery. The equipment includes three 450-hp Babcock & Wilcox boilers, General Electric generators and turbine engines. The distribution plant will also be extended.

WEST POINT, VA.—Broaddus & Byers, of West Point, are the engineers for an electric light plant for West Point.

WOODSTOCK, VA.—The Woodstock Electric Light & Power Company has been incorporated with a capital of $2000 to $10,000.

MARTINSVILLE, VA.—The Town Trustees have secured an option on the water power of Smith River, about 1½ miles south of Martinsville, and have employed A. L. Scott, representing Lockwood & Green, of Boston, Mass., to make a survey and estimate the cost of bringing this power to the town by electric transmission. The probable cost of the plant is $70,000.

WALLA WALLA, WASH.—A $250,000 mortgage has been filed by the Baker Loan & Investment Company of this city against the electric light plants, water rights, rights of way and other property of the Washington & Oregon Power Company, which is building a large plant on the South Fork of the Walla Walla River to supply power, etc., to Walla Walla, Wash. and Pendleton, Ore. The Washington & Oregon Company has also purchased the local plant at both Walla Walla and Pendleton.

MENOMONEE FALLS, WIS.—This city is reported interested in the construction of an electric light plant.

BURLINGTON, WIS.—An election will probably soon be held to vote on issuing $27,000 bonds for an electric light plant.

ANTIGO, WIS.—The station of the Antigo Electric Light & Power Company was destroyed by a fire of unknown origin on May 5. The loss on machinery is estimated at $20,000, but the indirect loss will be large, as the city is without light, and many small factories are compelled to shut down for lack of power All the local newspapers were also put out of business temporarily for the same reason.

OTTAWA, ONT.—It is reported that the Consumers' Electric Company will expend $30,000 in laying conduits from Chaudiere to its power station on Maria Street.

ST. CATHERINES, ONT.—The Lincoln Electric Light & Power Company of this place will install a 300-kw generator and will build a three-phase line to the power house of the Hamilton Cataract Power, Light & Traction Company for the lighting of the new Welland Canal.

## THE ELECTRIC RAILWAY.

BIRMINGHAM, ALA.—The survey of the proposed electric railway from Bessemer to Blue Creek is finished. As soon as the report of the engineers has been accepted a company will be formally organized by the subscribers and work begun.

SAN FRANCISCO, CAL.—The Ione & Eastern Railroad Company (Electric) has been incorporated. The directors and stockholders are Jackson Dennis, of Amador County, and J. J. Fagan, William Pardy, R. E. Wallace, H. H. Ferns and S. C. Sheeline, of San Francisco. The capital stock is $1,000,000.

DENVER, COL.—The Northern Colorado Electric Railway Company has filed its articles of incorporation with the Secretary of State at Denver. The principal offices will be located at Fort Collins. The main line will run from Fort Collins to Denver. Branch lines are planned between Fort Collins, Eaton and Greeley and Fort Collings, Chambers' Lake, Walden and thence to the Grand River in Grand County. The capitalization is $1,000,000. The directorate is composed of P. J. McHugh, L. C. Moore, R. L. McCullogh, H. A. Edmonds and W. A. Mosman.

MERIDEN, CONN.—The transformer plant which the Meriden Electric Railroad Company has been erecting at Hanover Park has been completed. Under the new arrangement the power to operate the local electric railway will be transmitted from the New York, New Haven & Hartford Railroad Company's station at Berlin, a distance of 9 miles. The old power plant on Pratt Street will be kept in readiness for use in cases of emergency.

MT. VERNON, ILL.—The Southern Illinois Electric Railway Company, which has in contemplation the construction of an extensive system of electric railways in this territory, has voted to increase its capital stock from $50,000 to $2,000,000.

ALTON, ILL.—The Alton Light & Traction Company has awarded the contract for building an embankment for its electric railway from Alton to East Alton, and may continue to build the line into St. Louis, independent of the St. Louis syndicate.

MT. VERNON, ILL.—The Traction, Engineering and Construction Company has been incorporated, with a capital stock of $2500, by John R. Piercy, Isaac A. Smith, Fred. L. Webster, E. C. Parker and William C. Blair. The same interests are connected with the Southern Illinois Electric Railway, and the inference is that the Traction, Engineering & Construction Company will build the Southern Illinois Company's lines.

JEFFERSONVILLE, IND.—The Jeffersonville City Railway Company has been purchased by Peter Arundel, representing Louisville capital, and is now being equipped with electricity. The road extends from Jeffersonville to Port Fulton.

KOKOMO, IND.—The Kokomo, Marion & Western Traction Company is building a new power plant with a capacity of 800-kw, all units being direct-

connected. The cost of the plant will be $50,000 and the new equipment will be ready for operation July 1 next.

MUNCIE, IND.—A franchise has been granted the Oil Belt Traction Company through the northern portion of Delaware County. It is proposed to build from Alexandria through the northern part of the country to Celina, Ohio. A branch will be extended from Gaston to Muncie.

BOSTON, MASS.—The Railroad Commissioners have authorized the Boston & Worcester Street Railway Company to issue $100,000 additional capital stock at $100 per share; also $200,000 twenty-year 4½ per cent. bonds, the proceeds to be used to pay off floating debt incurred in constructing and equipping the road.

JACKSON, MICH.—Articles of incorporation of the Consolidated Traction Company, of Jackson, have been filed with the Secretary of State. The new company is one formed by W. A. Bowland to take over the property of the Jackson & Suburban Traction Company, now operating the Jackson City lines and a road to Grass Lake, and also a spur line connecting Wolf Lake resort and casino, 10 miles east of Jackson, with the Roland system. The new company is at present independent of the Jackson & Battle Creek Traction Company, and also of the Jackson & Ann Arbor Company. The capital stock of the new company is $1,000,000.

ST. LOUIS, MO.—The St. Louis Elevated & Subway Railroad Company has applied to the City Council for the second time for a franchise to build and operate an elevated and underground railroad subway and tunnel for passenger service from Third Street and Washington Avenue to the city limits. H. K. Gilman, S. L. Langsdale, Harry S. Doyle and J. E. Longworth are interested.

ST. LOUIS, MO.—Further changes in the management of the St. Louis Transit Company, looking to a general reduction of operating expenses, are about to take place. General Manager Robert McCulloch has announced the resignations of W. O. Mundy, chief engineer, and Superintendent Dunne, of overhead construction, both to take effect on or about May 1. Their duties will be merged into those performed by other officers.

JERSEY CITY, N. J.—The North Jersey Street Railway Company has purchased a large tract of land on the Hackensack river front on which it will erect a large power plant. Power for the entire trolley system east of the Hackensack River will be supplied from this station. Architects are now at work on the plans and it is stated that the cost of the buildings and machinery will be at least $400,000.

CUBA, N. Y.—W. F. Mayo, of Cuba, and others, have recently been in conference here regarding the building of an electric railway from Cuba to Weston's Mills, a distance of about 16 miles.

NEW YORK, N. Y.—The proposal of the New York & Jersey Railroad Company to continue its Hudson River tunnel from the terminus of West Tenth and Hudson Streets, originally proposed, under Sixth Avenue and to Thirty-third Street, has been reported adversely by the committee that had the matter in charge.

ROCHESTER, N. Y.—At the annual meeting of the stockholders of the Albion Electric Railway Company the following directors were chosen: Charles B. Hill, E. C. Lufkin, C. L. Ingham, George H. Sickles and Frederick B. Griffith, Jr., of Buffalo; Alvah K. Potter and George E. Greene, of Lockport; Lorenzo Burrows and George B. Church, of Albion. The directors elected these officers: Charles B. Hill, of Buffalo, president; Frederick B. Griffith, Jr., of Buffalo, secretary and treasurer.

ROCHESTER, N. Y.—Senator Merten E. Lewis, attorney for the promoters, says the electric railway from Rochester to Caledonia is assured. The company will be incorporated in about two weeks. Plans and surveys have been completed. The road is to be known as the Rochester, Scottsville & Caledonia Railroad. The subscribers to the new company are: Henry C. Brewster, John F. Alden, Charles T. Chapin and Le Grand Brown, of Rochester; D. C. Becker, of Fairport; Andrew H. Brown, of Penfield; Charles H. Palmer, Eugene Brown, Selden S. Brown and Isaac W. Salyerds, of Scottsville. The company is to be capitalized at $250,000. Henry C. Brewster is to be president of the corporation.

COHOES, N. Y.—The Cohoes Railway Company has filed papers of incorporation with the Secretary of State. The capital is $120,000. The new company is a reorganization of the Cohoes City Railway, which was sold at auction recently. The directors are P. C. Dugan, John W. McNamara, president of the United Traction Company, of Albany; James McCredie, Edgar S. Fassett, Reuben C. Calkins, Eugene Crawford and Thomas Van Antwerp, of Albany; James N. Wallace, of New York, and John E. MacLean, of Cohoes. The stockholders have authorized the issue of the mortgage which is a part of the plan of reorganization. The United Traction Company interests are the controlling factor in the company.

NEW YORK, N. Y.—The Central Crosstown Railroad, which is controlled by the Metropolitan Street Railway Company, has sold to Kuhn, Loeb & Company $2,250,000 of two-year 5 per cent notes, secured by deposit of $2,250,000 guaranteed bonds of the Crosstown Company. The proceeds reimbursed the Metropolitan Securities Company for the money advanced in electrifying the crosstown system. Kuhn, Loeb & Company have also purchased $2,300,000 of the Metropolitan Street Railway refunding 4 per cent. bonds, the proceeds from which will be used in part to pay off the $1,500,000 Broadway & Seventh Avenue first 5s, maturing June 1, and the balance for other refunding operations. This increases the outstanding refunding 4s to $15,080,000. In addition, Kuhn, Loeb & Company have bought $2,000,000 of Third Avenue first consolidated 4s, increasing the outstanding issue to $37,000,000. The new bonds are issued to pay for improvements and other purposes.

CHARLOTTE, N. C.—The route has been surveyed for a trolley line connecting Roanoke, Va., and Mount Airy, N. C.

MARIETTA, OHIO.—The Parkersburg, Marietta & Interurban Railway Company is securing right of way for a line up the Muskingum River Valley to Devol.

DEFIANCE, OHIO.—The Ohio Northern Traction Company is making surveys for its line which is to extend from Defiance to Wauseon, O., and Adrian, Mich.

CAMBRIDGE, OHIO.—The Consolidated Company has filed an amendment to its charter changing its name to the Cambridge Power, Light & Traction Company.

COLUMBUS, OHIO.—The Chillicothe, Bainbridge & Aberdeen Electric Railway Company has been incorporated, with $50,000 capital stock. The incorporators are G. F. Horn, A. A. Luther, O. R. Eyler and Floyd E. Furneau.

INDIANA, PA.—The Indiana Street Railway Company and the Indiana & Blairsville Intersection Street Railway Company have been merged.

WASHINGTON, PA.—The Washington County Street Railway Company has been granted a franchise here. The plan of the company is to build an electric railway from Washington to Pittsburg.

BRADFORD, PA.—It is said that the Bradford Street Railway Company's property and franchise have been purchased by a party of Philadelphia capitalists, and that the Olean, Rock City & Bradford Company is included in the deal.

EASTON, PA.—The Easton Transit system and its allied roads in Easton and Phillipsburg, and the Easton, Palmer & Bethlehem road, now controlled by the Lehigh Valley Traction Company, are to revert to the Easton Consolidated Electric Company. H. R. Fehr is to assume control for the old company. The Lehigh Valley Traction Company has defaulted in the payment of the rentals of its leased lines, and the receivers have been unable to better conditions to any great extent.

CHATTANOOGA, TENN.—The Rapid Transit Company of Chattanooga will issue $250,000 in bonds for improvements and extensions of its consolidated lines.

BEAUMONT, TEX.—It is reported that a large part of the stock and bonds of the Beaumont Traction Company has passed into the hands of a Boston syndicate.

SALT LAKE CITY, UTAH.—Work on the Salt Lake Southern electric railway, which will traverse several miles of the suburbs of the city, has been resumed. The company has filed with the county clerk amended articles of incorporation, increasing the capital stock from $500,000 to $2,000,000, and the Knickerbocker Trust Company, of New York, has been designated as trustee. It was stated recently that $1,500,000 will be expended this year in construction work. A power plant with a capacity of 3500 horse-power is to be established by the company a few miles south of the city.

DANVILLE, VA.—The Danville Street Railway & Electric Company has asked the permission of the County Circuit Court to extend its line to Stokesland, 5 miles south of this city. The line will be extended this spring to the Country Club, beyond the suburbs.

WEST SEATTLE, WASH.—It has been voted to issue $18,000 worth of bonds by the city to build an electric street car line. The city is to own and operate the road.

EAU CLAIRE, WIS.—The Chippewa Valley Electric Railroad Company, of which Arthur E. Appleyard is president, has taken over all of the property of the Eau Claire Light & Power Company, including its franchise.

FOND DU LAC, WIS.—The Fond du Lac Northwestern Railway Company has increased its capital stock from $100,000 to $750,000. Work has been started on the Fond du Lac end of the road, and it is thought a branch will be built to this city, connecting with the Green Bay-Kaukauna interurban.

NEW WESTMINSTER, B. C.—W. Blackmore & Son, architects, have prepared plans for a sub-station to be built by the British Columbia Electric Railway Company.

## NEW INDUSTRIAL COMPANIES.

THE CENTURY GAS & ELECTRIC FIXTURE COMPANY, of New York, has been incorporated with a capital stock of $3000. The directors are S. M. Israel, E. M. Pine and S. H. Shinnisky, New York.

THE WOOD CHANGING SIGN COMPANY, of New York, has been incorporated with a capital stock of $100,000. The directors are N. B. Wood and W. A. Kroyer, New York, and B. B. Austin, Brooklyn.

THE JOHNSON ELECTRICAL MANUFACTURING COMPANY, of Phoenix, Ariz., has been incorporated with a capital stock of $200,000. The incorporators are W. Frederick Nutt and Charles H. Johnston.

THE H. R. & K. MANUFACTURING COMPANY has been incorporated in New York to deal in electrical appliances. The capital stock is $75,000 and the directors are W. E. Knight, Fanwood, N. J., and H. C. Workman and M. A. Ryan, New York.

THE HUTCHISON WIRELESS TELEPHONE COMPANY has been incorporated at St. Louis with a capital stock of $3000. The incorporators are M. R. Hutchison, Hallon C. Spaulding, Edward C. Husted, L. Z. Harrison and Joseph A. Wright.

THE TAPE TRANSMITTER MANUFACTURING COMPANY has been incorporated in Jersey City, N. J., with a capital stock of $100,000. The incorporators are Edward T. Clarke, Jersey City, and Elihu Beach and Loyal Ward Reynolds, New York City.

THE ALLENTOWN ELECTRIC CONSTRUCTION & SUPPLY COMPANY has been incorporated at Allentown, Pa., with a capital stock of $30,000. The incorporators are U. H. and W. E. Wieand, W. H. Gangawere, R. E. Wright, J. R. Druckenmiller and W. H. Miller.

THE NEEL ARMSTRONG COMPANY has been organized at Portland, Me., for the purpose of manufacturing and dealing in electrical apparatus. The capital stock of the new concern is $200,000, of which nothing has been paid in. The officers are: President, Willard C. Baldwin; treasurer, Geo. C. Knight.

## LEGAL.

WESTERN UNION VS. PENNSYLVANIA.—Judge Gray on May 2 handed down an opinion in the United States Court of Appeals at Philadelphia remanding the case of the Western Union Telegraph Company against the Pennsylvania Railroad Company to the Circuit Court for further proceedings. The litigation involves the right of way of the telegraph company along the lines of the Pennsylvania Railroad Company, and the United States courts in that district have always sustained the position of the railroad. The last decision, however, reverses the Circuit Court on a demurrer raised by the telegraph company and the case is sent back to the lower court for a hearing on its merits.

TO OUST CUMBERLAND TELEPHONE.—At Nashville, Tenn., on May 2, Chancellor Allison handed down a decision to-day ordering that the Cumberland Telephone & Telegraph Company, a Kentucky corporation, be ousted from the State. An appeal to the Tennessee Supreme Court was taken. The grounds for the decision are discrimination and conspiracy to stifle competition. A receiver was also asked for, but the court declined to appoint one, "for satisfactory reasons." One specific charge is that the leasing of the Maury County or Columbia Exchange to Leland Hume, an officer of the Cumberland Company, was an evasion of the law, and designed to permit rates to be illegally cut. It was also charged that the defendants had broken down independent concerns elsewhere by methods which they had no right to practice. Officials of the Cumberland Telephone and Telegraph Company decline to make any statement further than to assert that their business will continue to be transacted as usual. The company has an authorized capital of $20,000,000 and about $12,000,000 is outstanding.

## OBITUARY.

MRS. MARY PECK, mother-in-law of Prof. Elihu Thomson, and Mr. E. F. Peck, manager of the Schenectady, N. Y., electric railway system, died last month at Lakewood, N. J. She was the daughter of the Rev. Dr. Emerson Davis, of Westfield, Mass., and widow of Mr. Charles Peck, of New Britain, Conn. She was a woman of strong religious convictions, active social sympathies and prominent in all kinds of philanthropic work. Her death at the Laurel House, Lakewood, was due to a slip and falling down a flight of stairs.

## EDUCATIONAL.

HEBREW TECHNICAL INSTITUTE, New York City, will hold its commencement exercises on Wednesday evening, May 18, in the large hall of Cooper Union, preceded by an exhibit of work of the graduating class at the Institute, Stuyvesant Street.

ELECTRO-RADIO THERAPY.—The importance that radio-activity is assuming as an agent in the treatment of disease is emphasized in the establishment by the trustees and medical faculty of the New York Polyclinic Medical School and Hospital of a special department of electro-radio therapy.

PRATT INSTITUTE, Brooklyn, N. Y., in its March *Monthly* gives the annual report of the department of science and technology, including a very interesting illustrated description of the electrical laboratory and the methods adopted there of instruction in testing apparatus, cables, etc. The report is signed by Mr. S. Sumner Edwards, who is to be congratulated upon this useful report of good work done.

## PERSONAL.

MR CLARENCE GEORGE has been appointed city electrician of Houston, Tex., by Mayor Jackson.

MR. WALTER H. GRAEFF, of G. & O. Braniff, Mexico City, which concern represents the Westinghouse interests in the Southern Republic, is now on a visit to the States.

CAPT. C. F. GOODRICH, U. S. N., has an interesting article in the latest (March) issue of the *Proc. U. S. Naval Institute* on "Cable Cutting." It is full of data with reference to this important topic.

MR. L. W. MILLER, secretary of the Goudey-McLean Company, 120 Liberty Street, New York, is expected back very shortly from Europe, where he has been for some two years past in connection with the company's business.

MR. J. J. O'BRIEN, who has been for some years past cashier of the Chicago Edison Company has resigned and has become general auditor for the H. M. Byllesby & Company, the consulting and contracting electrical engineers of Chicago and New York.

MR. J. L. LYLE, manager of the New York City offices of the Buffalo Forge Company, has been appointed secretary of the Engine Builders' Association, vice Mr. D. L. Fleming, of the Harrisburg (Pa.) Foundry & Machine Works, who has resigned from the position under pressure of business.

MR. J. W. STEED, of the International Steam Pump Company, will have charge of the installing of the electrical equipment, machine tools, etc., at the huge Worthington works now being hastened to completion at Harrison, N. J. Practically all the electrical equipment will be of General Electric manufacture.

MR. CHARLES H. LEDLIE, Rialto Building, St. Louis, was the consulting engineer of the Kansas City Telephone Company's plant described recently in these pages, the entire system including switchboards, desk equipment and telephones, as well as the outside construction work, having been built under specifications prepared by him, and the work done under his immediate supervision.

MR. H. V. CROLL, who has been in charge of the Salt Lake City, Utah, office of the Allis-Chalmers Company for several years, and who was before that the representative of the E. P. Allis Company at Spokane, Wash., has been appointed to the charge of the Allis-Chalmers office in San Francisco, as the successor of Mr. Geo. Ames, who has resigned. Mr. Croll's San Francisco office is 623 Hayward Bldg.

PROF. S. P. THOMPSON, F. R. S., is now busily engaged on the second volume of his new edition of "Dynamo Electrical Machinery," in which he is giving special care and attention to the subject of alternators. When it is off his hand, he intends making a final effort to complete the rewriting of that valuable work, "The Electro Magnet," now seven years in process of execution, to embrace a large amount of original matter.

CHARLES HENRY DAVIS & PARTNERS, of New York City, have issued an announcement of the dissolution of this firm from May 1, and the formation of Charles Henry Davis & Company, at 25 Broad Street, by that gentleman and Mr. Nat Tyler, Jr. As to the other old members, Mr. T. W. Sprague will practice at 4 State Street, Boston, Mr. John S. Griggs, Jr., 25 Broad Street, and Mr. J. Byers Holbrook, at the same address.

MR. C. P. BRUCH, assistant general manager of the Postal Telegraph Cable Company, is also president of the Canton Society of New York, composed of men who came from President McKinley's city. The society gave a dinner on May 7 to their fellow townsman, Justice Day of the U. S. Supreme Court, at which a number of distinguished public men were present. Mr. Bruch presided and also discharged the duties of toastmaster in a very felicitous manner.

MR. PAUL G. BURTON, formerly chief inspector of the Western Electric Telephone installation department, has been appointed superintendent of maintenance of the Chesapeake and Potomac Telephone Company, the territory of which includes Baltimore and Washington. Before his departure from New York Mr. Burton was the guest of honor at a dinner given at the Arena by the Western Electric Foremen's Club, of which he had been president for several years.

DR. LEE DE FOREST, whose wireless telegraph system is being used so effectively in the Russo-Japanese war by the *New York Times* and *London Times*, is the subject of an interesting biographical sketch in the former paper. It is accompanied by an engraving which shows him mounted as a bugler of the Yale battery in the Spanish war of 1898, when he was one of the first of the New Haven men to enlist. The following year Yale made him a Doctor of Philosophy for his thesis on Hertzian waves.

MR. IRVING A. TAYLOR, who has for many years been connected with the electrical industry both on the manufacturing side and as consulting engineer associated with A. B. Herrick, has joined the staff of the Engineering Company of America. Mr. Taylor has had a very broad experience in central station work, not only with Edison systems but also with high tension transmission plants, one of his recent tasks being the installation of the 12,000-volt generators at the power house of the Niagara Falls Hydraulic Power Company.

MR. T. A. EDISON.—A dispatch from Washington, May 10, states that President Roosevelt recently overruled a decision of Patent Commissioner Allen in a case in which Mr. Edison is interested, and directed that a hearing be given to Mr. Edison, which had been denied. It appears, from the dispatch, that Mr. Edison applied for a patent in connection with his storage battery, and that another inventor working along the same lines, it is alleged, was permitted to withdraw his application and insert in it the substance of Mr. Edison's claims. Mr. Edison protested and asked for a hearing, which the Commissioner refused to grant. President Roosevelt was appealed to with the above result.

MR. S. STERN, vice-president and managing director in Europe of the American Electrical & Novelty Company, returned recently from a trip abroad. The company now has factories and selling agencies in Paris, Berlin and London. "The Germans take most kindly to our ideas and to our goods," Mr. Stern said, "but they are also the best imitators. In July, 1900, I established our first factory in Berlin for the manufacture of portable electric lights. The Germans had never heard of such a thing, then, but inside of a year I had seventy-five competitors. We created a new industry in Germany, and to-day there are at least 150 factories there making electrical devices. The Germans take to all our novelties and are our best customers." Mr. F. J. Alvin, president of the company, has also recently made a quite successful trip through Canada.

MR. G. MARCONI left England last Saturday by the Campania for New York. The ship has been equipped with long distance wireless apparatus, and during the entire voyage Mr. Marconi expects to be able to keep in communication with both shores. He is accompanied by Mr. W. W. Bradfield, engineer of the American Marconi Company, who has been with him for several months past studying the new apparatus designed for the operation of the trans-Atlantic system. The first station to be equipped will be that at Glace Bay, Nova Scotia, following which the station at South Wellfleet will be put in shape. When the stations on this side of the Atlantic have been opened for business there will be stations abroad, to which communications may be directed, at Poldhu, Cornwell and Pisa, Italy. By means of relay from these stations wireless communication may also be had with Amsterdam, Holland; LaHague, France; Gibraltar; Rosslare, Ireland, and other points.

MR. HERMAN A. STRAUSS was appointed general manager of the Sheboygan Light, Power & Railway Company, of Sheboygan, Wis., early this year. This company operates about 30 miles of city and interurban trackage and all the lighting systems of the city of Sheboygan. This appointment of Mr. Strauss comes after one year's service as engineer of the Construction Company of America in the design and construction of ten miles of interurban railway and a large, modern, fire-proof power station for the Sheboygan Light, Power and Railway Company. Mr. Strauss has had a large and varied experience. He was attached to the engineering staff of the Westinghouse Electric and Manufacturing Company for several years; he has acted for two years as an assistant electrical engineer for the Manhattan Elevated Railway Company of New York City, throughout the period of electrification of this system, and has done considerable independent consulting engineering work.

MR. W. E. SHELDON, formerly treasurer of the Fitchburg Steam Engine Company, who was afterwards connected with the Providence Steam Engine

Company and with the Providence Engineering Works, has become connected with the "Manufacturers Agency," Milk & Oliver Streets, Boston, Mass., which has rented an entire floor of 35 rooms in the Oliver Building there. The agency will act as selling agent and purchasing agent for manufacturers, furnishing capital, loans and everything convenient for manufacturers having dealings with it. The proposition is to finance companies and represent them through New England, reaching out for business in a manner which a moderate manufacturer cannot do. A large staff of traveling salesmen has been engaged who know the companies in that territory thoroughly, and who are experts in respective lines. To Mr. Sheldon has been given the engineering department, of which he will have full charge. Mr. J. F. Preston is the president of the organization.

# Trade Notes.

THE TOLEDO ELECTRIC STORAGE BATTERY COMPANY, Toledo, Ohio, capitalized at $100,000, has been re-organized with Mr. J. Grasser as president.

ELECTRIC POWER FOR BREWERY.—F. C. Werk, Cleveland, Ohio, has secured a contract for equipping the plant of the Isaac Leisy Brewing Company, of Cleveland, with electric power. A number of motors will be installed.

SPRAGUE ELECTRIC COMPANY has issued a bulletin devoted to its M. C. type motors, direct current, open form and enclosed form, intended for very general application. It is No. 216 and is well illustrated as well as full of detail data.

CUTLER-HAMMER IN WEST AUSTRALIA.—The Cutler-Hammer Manufacturing Company has appointed the West Australian engineering and contracting firm of Splatt, Wall & Co., Perth, as agents for the Cutler-Hammer specialties in that part of the world.

THE F. BISSELL COMPANY, Toledo, Ohio, has just issued a very neat little "Handbook of Switchboards." It is devoted to boards of 2500 amp. or less, complete or in parts, and is profusely illustrated by diagram as well as being carefully explicit as to details of every kind.

H. T. PAISTE COMPANY, Philadelphia, has issued some new calendar blotting pads for May, illustrating and describing its P. K. show window "fieldings," the P. K. Pushin attachment plug, etc. These specialties are thus attractively brought to notice.

THE PROVIDENCE ENGINEERING WORKS, of Providence, R. I., has established a New York office at 42 Broadway, N. Y., in charge of Mr. Wm. E. Hussey, who is well known in engine circles. The New York office will also cover the Philadelphia territory.

COLUMBIA INCANDESCENT LAMP COMPANY, of St. Louis, Mr. A. Garrison, president, has found it necessary to open an office in Minneapolis, and to carry a complete stock of lamps at that point in order to care properly for its large and growing number of customers in Minnesota and the Northwest. The business there has shown a remarkable increase. Mr. J. B. Coale, who formerly represented the company in the district named, will be in charge of the Minneapolis office.

INCREASE OF CAPITAL.—The directors of the Monarch Electric Manufacturing Company, of Warren, Ohio, have decided to increase the capital stock of the company from $10,000 to $50,000. The increasing business of the company requires larger capitalization in order that it may be more properly carried on. The outlook for the fall trade is stated to be very good and the plant will be operated throughout the summer so as to be able to meet the demand for the company's products.

MULTIPLE TAP CABLE SYSTEM.—Mr. L. W. Stanton, telephone engineer, Electric Building, Cleveland, has issued an interesting illustrated bulletin as to the merits of the "multiple tap" system for telephone services, as compared with older methods. This open-wireless or all-cable telephone method has been introduced with excellent results and is highly spoken of by experts and authorities. One view shows a single cable on pole at Austin, Minn., equal to a lead of five crossarms and 50 bare wires.

WARD-LEONARD ELECTRIC COMPANY, of Bronxville, N. Y., has just issued a new catalogue, No. 19,038, covering its enameled resistance units. On account of the increasing demand for new sizes of this resistance unit, it has catalogued three new sizes; one a tube 2 inches long and 7-16 inches diameter, upon which in extreme cases can be placed 5000 ohms resistance. Another is a tube four inches long by 7-16 inches diameter upon which can be placed 11,000 ohms. The SS type covers a tube suitable for small rheostats, as it is divided into eight steps. Copies of the bulletin can be had on application by any one interested.

GENERAL ELECTRIC COMPANY, through its power and mining department at Schenectady, N. Y., has just issued a very handsome and complete report dealing with the subject of electric mine haulage. It is a handsome, small quarto of 70 pages, profusely illustrated and gives also a great variety of interesting details and information, including several quoted articles, and considerable original data. It is the more valuable also because of the historical record presented; but probably its chief value lies in the impressive demonstration that it makes of the remarkable rapidity and extent of the adoption of electricity in mining operations all over the country.

THE MICA INSULATOR COMPANY, of 218 Water St., New York City, has incorporated the exhibit of its well-known specialty "Micanite," with that of the State of North Carolina, in the Mines and Metallurgy Building, St. Louis. The exhibit is an interesting object lesson showing to what utility and extent mica can be put in the ever-expanding field of electrical insulation. Micanite in all kinds of shapes and forms is shown, including flat sheets of various thicknesses, generator and motor commutator segments, and rings of many of the standard types; and Micanite tubes from one-eighth of an inch in diameter to the large tubes entering into the construction of induction coils for X-ray purposes.

ROSSITER, MacGOVERN & COMPANY, 71 Battery Place, New York City, have issued for May an elaborate bulletin of all the second-hand material which they now have ready for the market. The phrase "second-hand" is used advisedly as almost all of the material is of modern design and of standard manufacture; has been thoroughly overhauled in the Jersey City and St. Louis factories of the company, and is ready to go on any circuit to which it is adapted. In fact, Rossiter, MacGovern & Company are ready to equip complete plans for lighting or street railway work, and it would seem as though almost any want could be met from this complete and exhaustive catalogue covering every branch of the light and power industry.

NEW LEFFEL CATALOGUE.—The new catalogue of engines and boilers made by James Leffel & Company, of Springfield, Ohio, is a book that will interest many of our readers. It should interest any one who has to do with steam power. This book goes into the matter of the making of Leffel engines and boilers and shows on what their merit is based. It is well gotten up, printed on heavy enameled paper, has numerous full-page and many smaller illustrations, and is filled with just such detailed information about engines and boilers as to make it truly valuable to those using or contemplating using an engine or boiler. The book will be mailed free to prospective buyers of an engine or boiler, stating wants and addressing the company as above.

A FIREPROOF DREAMLAND.—The H. W. Johns-Manville Co., 100 William St., New York, is supplying the Dreamland Company, Coney Island, with several thousand squares of "Asbestoside" to be used for siding the buildings in "Dreamland," which will be the largest pleasure resort on Coney Island, and the summer attraction of several million people. "Asbestoside" was specified by the architects, Messrs. Kirby, Pettit & Green, of New York, and formally approved by the Building Department, which classified it as a "high grade, slow burning or fire retardent material." The distinctive features of "Asbestoside" are, that it is cut into sheets of 7 feet and crated; is easily applied being finished with large head galvanized nails which are covered with a half round wooden beading or moulding, and does not require painting of any description with the exception that the wooden strips may be tinted any desired color in contrast to the siding which is white. "Asbestoside" is superior to metal siding, along the sea coast, as it will not rust or decay and the first cost is cheaper, besides doing away with the annual coating.

THE STANDARD UNDERGROUND CABLE COMPANY, in conjunction with the McRoy Clay Works, has a joint exhibit in Section 3 immediately adjoining the northwest entrance of the Electricity Building, St. Louis. The exhibit shows a cross-section of an actual conduit consisting of 72 ducts, with a manhole at either end, one manhole being complete with a cover, the other being open. A trench 7 feet deep and 5 feet wide extends the entire length of this conduit, enabling close inspection of the method of laying conduits, including the wrapping, concrete base and top, and the general construction of the manholes, showing hangers, pipes to poles, etc. At one end in the manhole is shown a capstan rigged up for drawing in cables and connected to a cable which is mounted on a reel at the other manhole; the cable being drawn through the ducts and part of the ducts being split so as to show the method of fastening cables to rope, etc. From the manholes, cables go to distributing poles, showing the method of distribution to aerial cables for telephone, electric light and street railway work with various terminals used to protect the ends of the cable in such work. The McRoy Clay Works show piles of clay as it is dug from the ground and the various processes through which the material goes to produce the finished duct. The Standard Underground Cable Company shows samples in handsome cases of all the various cables and appliances made by it. An examination of this system will show, in very complete detail, the method of installing conduits and drawing cables into completed conduits.

# Record of Electrical Patents.

UNITED STATES PATENTS ISSUED MAY 3, 1904.

[Conducted by Rosenbaum & Stockbridge, Patent Att'ys, 140 Nassau St., N. Y.]

758,610. CONTROLLER FOR ELECTRIC MOTORS; Thomas E. Barnum, Milwaukee, Wis. App. filed Feb. 7, 1902. A number of switches connected in series and situated at a distance from the rheostat, for stopping and starting the motor independent of the rheostat.

758,621. HIGH TENSION CIRCUIT BREAKER; Harry P. Davis, Pittsburg, Pa. App. filed Sept. 13, 1902. A construction to prevent danger to neighboring objects from the arc and a means for indicating when the circuit breaker is automatically opened and another means for positively indicating at all times whether the breaker is open or closed.

758,623. TELEPHONE SYSTEM; William W. Dean, Chicago, Ill. App. filed May 11, 1904. (See page 913.)

758,631. COLLECTOR RINGS AND BRUSH HOLDERS; Karl F. Ehlers, Pittsburg, Pa. App. filed Sept. 26, 1903. The object is to provide brush-holder collecting rings for machines having a relatively large number of brushes which shall occupy the smallest amount of space.

758,635. DIRECT CURRENT GENERATOR; William H. Foot, Wilkinsburg, Pa. App. filed Sept. 16, 1903. Relates to the mounting of cross-connecting rings and their connections to the bars of the commutator.

758,638. LIGHTNING ARRESTER; Louis R. Gaw, Asbury Park, N. J. App. filed June 3, 1903. Details.

758,644. ELECTRIC ARC LAMP; Thomas Hamilton-Adams, London, England. App. filed Aug. 29, 1903. Two coils with tubular iron linings and connected in series are substituted for the usual solenoid, the said coils being wound in the same direction and placed one above the other some distance apart and mounted on a tube of non-magnetic material through which the upper electrode passes.

758,646. FUSE BLOCK; John A. Heany, York, Pa. App. filed Oct. 12, 1903. Details.

758,647. ELECTRIC SAFETY FUSE OR CUT-OUT; John A. Heany, York, Pa. App. filed Oct. 12, 1903. A non-conducting plug having an eccentric passage for the fuse with metal end caps having perforations corresponding

in position to the bore of the tube, so that by twisting the caps, the fuse can be cut off at a definite length and then held in position by the cap.

758,648. ELECTRIC SAFETY FUSE OR CUT OUT; John A. Heany, York, Pa. App. filed Oct. 13, 1903. Special clamps adapted to engage the caps referred to in the preceding patent, to place them in circuit.

758,649. ELECTRIC SAFETY FUSE OR CUT OUT; John A. Heany, York, Pa. App. filed Oct. 14, 1903. A tube lined with a protective layer and having two metallic plugs arranged therein in which the fuse is centered.

758,650. ELECTRODE FOR VAPOR ELECTRIC APPARATUS; Peter Cooper Hewitt, New York, N. Y. App. filed Jan. 13, 1904. To prevent the spark where the current enters the negative electrode from wandering over its surface, a platinum point is projected from the surface of the mercury electrode, upon which the current enters.

758,655. MAGNETIC ORE SEPARATOR; William L. Imlay, Philadelphia, Pa. App. filed Oct. 2, 1899. Details.

758,669. BRUSH HOLDER FOR ELECTRICAL MACHINES; Benjamin G. Lamme, Pittsburg, Pa. App. filed Sept. 16, 1903. Details.

758,683. SYSTEM OF ELECTRICAL DISTRIBUTION; John S. Peck, Pittsburg, Pa. App. filed Aug. 8, 1903. A system for so distributing the self induction included in the alternating current side of systems of distribution employing rotary converters, that equal differences of potential may be obtained between slip rings belonging to the different phases.

758,684. MOISTURE PROOF CASE OR RECEPTACLE; John S. Peck, Pittsburg, and Albin L. Zwarnik, Braddock, Pa. App. filed Sept. 16, 1903. A corrugated metal casing with specially constructed joints for transformers.

758,692. STORAGE BATTERY; William J. Redmond, Cleveland, Ohio. App. filed Sept. 29, 1902. (See page 913.)

758,701. ELECTRIC BURGLAR AND FIRE ALARM; Solomon Schwarzschild, Rochester, N. Y. App. filed Feb. 24, 1902. A local circuit including an induction coil and vibrator is placed at the premises to be protected and is adapted to send a characteristic signal over a telephone circuit running to the premises.

758,703. APPARATUS FOR TELEPHONE LINES; Charles E. Scribner and James L. McQuarrie, Chicago. Ill. App. filed April 2, 1900. (See page 913.)

758,710. TITANOUS COMPOUND AND PROCESS OF MAKING SAME; Howard Spence, Manchester, Eng. App. filed Sept. 11, 1902. (See page 913.)

758,713. LEACHING APPARATUS; Geo. W. Stead, Philadelphia, Pa. App. filed July 26, 1902. The scrapers projecting into the pan have hinged lips that yield in one direction, but are stiff in the other, so that as the pan is reciprocated, the solid material is moved along the bottom of the pan step by step.

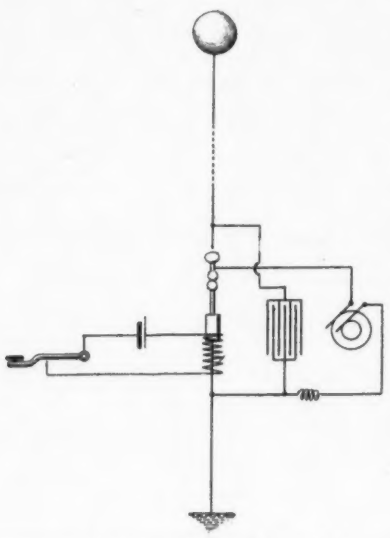
758,722. CONTROLLER REGULATOR; Vandiver J. Von Horn, Keokuk, Ia. App. filed Sept. 10, 1900. Details of a governing device which will enforce a gradual operation of the controller.

758,724. SIGNALING SYSTEM; Joseph Weatherby, Jr., New Cumberland, Pa. App. filed June 1, 1903. Details.

758,730. ELECTRIC LAMP; Alexander J. Wurts and Edward Bennett, Pittsburg, Pa. App. filed Jan. 10, 1901. The insulating frame upon which the parts of a glow lamp are mounted, is covered with a readily removable coat which receives the particles given off when the lamp is burning and by a timely removal of which short circuits may be prevented.

758,732. PRINTING TELEGRAPH; John C. Barclay, New York, N. Y. App. filed July 24, 1903. An arrangement of selecting relays and associated devices whereby the operation of a single relay in a single main line circuit controlling the selective action of the selecting relays, any one of a plurality of type-bars may be actuated at will.

758,650.—Electrode for Vapor Electric Apparatus.



758,842.—Wireless Telegraphy.

758,736. AUTOMATIC FIRE AND BURGLAR ALARM TELEGRAPH; Robert G. Callum, Washington, D. C. App. filed March 1, 1902. Details of construsction of a transmitter.

758,775. APPARATUS FOR THE TREATMENT OF GASES; Harry Pauling, Gelsenkirchen, Germany. App. filed Nov. 20, 1903. Apparatus for the continuous treatment of gases by means of spark discharges in such a manner that every particle of the gas is brought into contact with the spark.

758,795. TELEPHONE RECEIVER; Ernest Hugo Strauss, Chicago, Ill. App. filed July 25, 1902. (See page 913.)

758,842. WIRELESS TELEGRAPHY; James F. King, Washington, D. C. App. filed Dec. 17, 1902. The improvement consists in creating a flaming arc in a normally closed generator circuit and simultaneously connecting around the arc a capacity in a vibratory circuit.

758,855. RAILWAY SIGNAL; Edward F. Ryman and Edward W. Stevenson, Wilkesbarre, Pa. App. filed Oct. 19, 1903. Details.

758,860. SELF PLAYING MUSICAL INSTRUMENT AND NOTE SHEET THEREFOR; Chas. A. Shaffer, Philadelphia, Pa. App. filed July 21, 1903. The several movements of the note sheet and the actuation of the notes are obtained by means of a metallic sheet having both surfaces covered with insulating material which is removed in spots where contact fingers are to close the circuit.

758,883. METHOD OF GENERATING GASEOUS MEDIUMS FROM AIR; James N. Alsop, Owensboro, Ky. App. filed May 29, 1903. (See page 913.)

758,884. APPARATUS FOR GENERATING GASEOUS MEDIUMS FROM AIR; James N. Alsop, Owensboro, Ky. App. filed May 29, 1903. (See page 913.)

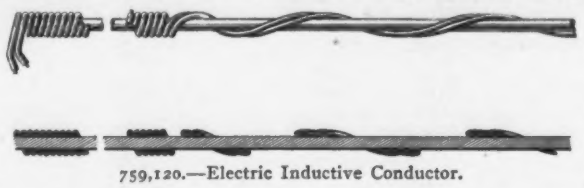
758,922. SIGNALING ON ELECTRIC TRACTION SYSTEMS; T. H. Jones, Portsmouth, England. App. filed July 7, 1902. Details.

758,938. AUTOMATIC MAGNETO CIRCUIT BREAKER; William M. Scott, Philadelphia, Pa. App. filed July 31, 1903. Improvements in the tripping mechanism.

758,946. ELECTROHEATER; Edwin R. Waterman, San Francisco, Cal. App. filed July 13, 1903. A liquid heater consisting of a number of concentric interspaced cylinders each containing electric heating devices.

758,954. AUTOMATIC CUT OFF IN TIME OF STORM; Frank P. Bell, Fairfield, Washington. App. filed April 24, 1903. Details.

758,977. GUARD COVERING FOR THIRD RAILS OF ELECTRIC RAILWAYS; John Kress, New Rochelle, N. Y. App. filed Dec. 30, 1903. A



759,120.—Electric Inductive Conductor.

housing for the third rail in which the roof is divided into two laterally sliding parts, which are moved aside by the plow as it progresses and afterwards automatically closed.

758,986. TUBULAR INSULATOR; Fred M. Locke, Victor, N. Y. App. filed Nov. 11, 1901. A plurality of shelves one arranged within the other and having a double conical shape around the center of which the line wire is secured.

759,004. ALTERNATING CURRENT MOTOR; Burton McCollum, Lawrence, Kan. App. filed April 4, 1903. Means for producing in the field of the motor, a special component of magnetism in phase with the main component in space, but differing therefrom in time, preferably by 90°.

759,007. STORAGE BATTERY; Job Thomas Niblett, Greenwich, Eng. App. filed Feb. 5, 1903. (See page 913.)

759,026. ELECTRIC CLOCK; Herbert Scott, Bradford, and Alfred Loebl, London, England. App. filed June 10, 1903. A ratchet wheel and the oscillating means are obliquely arranged to each other, the driving pawl for the ratchet wheel being carried by the oscillating means with the parts so arranged that the power applied by the pawl to the wheel is in a substantially direct line with the movement of the actuated tooth.

759,047. ELECTRIC SIGNAL SYSTEM; George L. Vannais, Hartford, Conn. App. filed June 20, 1903. Details.

759,058. STORAGE BATTERY; Vincent G. Apple, Dayton, Ohio. App. filed June 5, 1901. (See page 913.)

759,060. ELECTRIC RAILWAY SWITCH-POINT AND OPERATING MEANS THEREFOR; Arthur J. Backer, Spracuse, N. Y. App. filed July 8, 1903. The magnet which throws the switch tongue is located in a chamber inside of the tongue itself.

759,062. DEVICE FOR DISTRIBUTING NOXIOUS FUMES; Lyman M. Beckes, Vincennes, Ind. App. filed June 26, 1903. The closure of an electric circuit by a burglar will release noxious fumes intended to overcome him.

759,065. METHOD OF ACCUMULATING AND USING ELECTRICAL ENERGY; Anson Gardner Betts, Troy, N. Y. App. filed Aug. 17, 1903. (See page 913.)

759,066. ELECTRIC STORAGE BATTERY; Anson Gardner Betts, Troy, N. Y. App. filed Aug. 17, 1903. (See page 913.)

759,094. TELEPHONE TRANSMITTER; James I. Gemmill, Cleveland, Ohio. App. filed Aug. 28, 1901. (See page 913.)

759,095. TELEPHONE RECEIVER; James I. Gemmill, Cleveland, Ohio. App. filed Dec. 22, 1902. (See page 913.)

759,096. FRICTIONAL ELECTRIC GENERATOR; Garabet Germakian, Paterson, N. J. App. filed Aug. 22, 1903. The generation of static electricity is aided by providing a heating device other than that due to friction, the heat of which is applied to the plate.

759,098. SAFETY DEVICE FOR ELECTRIC RAILWAYS; George Gibbs, New York, N. Y. App. filed Dec. 24, 1903. The invention is concerned with providing means for cutting off the current in classes of accidents where the working conductor is not interfered with, or in an emergency at the will of an authorized person.

759,119. ELECTRICAL CONDUCTOR; Percy A. McGeorge, West Hoboken, N. J. App. filed Sept. 10, 1902. Two conductors are placed in parallelism with a magnetic strip arranged between them, but electrically insulated, the object being to provide a magnetic as well as an electric conductor.

759,120. ELECTRIC INDUCTIVE CONDUCTOR; Percy A. McGeorge, West Hoboken, N. J. App. filed March 17, 1904. A modification of the preceding invention in which the magnetic conductor is spirally wound by the two electric conductors.

759,121. POLE CHANGER; Roger M. Newbold, Birmingham, Ala. App. filed Aug. 19, 1903. Details.

759,122. ELECTRIC DYNAMO; Roger M. Newbold, Birmingham, Ala. App. filed Nov. 3, 1903. A casing especially adapted to axle-driven railway car dynamos, permitting ready access to the parts.

759,148. ELECTRIC ATTACHMENT FOR ROCKING CHAIRS; Gaines M. Allen and Samuel M. Cawker, Denver, Colo. App. filed Nov. 3, 1903. The movements of the chair are utilized to generate a small current to electrify metal plates placed at various points on the chair, so that a person occupying the chair will receive the current.

759,150. MOTOR STARTER; William Baxter, Jr., Jersey City, N. J. App. filed Feb. 9, 1904. A motor starter provided with a main switch and a rheostat switch, both of which are controlled independently by a magnet that is energized by two coils, one being connected in series with the armature, and the other in shunt relation thereto.

759,166. POWER TRANSMITTER; George M. Eames, Bridgeport, Conn. App. filed Sept. 25, 1903. A device for driving sewing machines comprising a power transmitter which can be operated independently of the motor to stop and start the machine while the motor is continuously in operation.

759,210. SUPPORT FOR FIELD WINDINGS; Bernard A. Behrend, Norwood, Ohio. App. filed Dec. 7, 1903. The winding is supported upon the core by a supporting frame that sustains it interiorly and exteriorly.

759,216. WIRELESS SIGNALING APPARATUS; Lee De Forest, New York, N. Y. App. filed March 14, 1903. The receiving apparatus comprises a syntonic and non-syntonic receiving system, each containing a wave-responsive device; also an indicating device connected with both wave-responsive devices and oppositely effected thereby.

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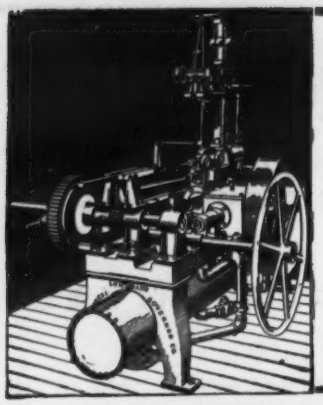

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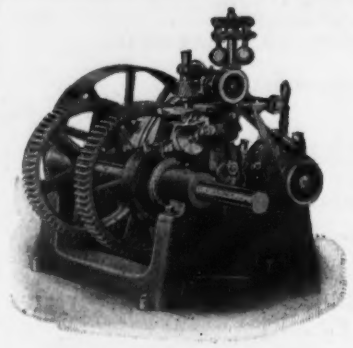

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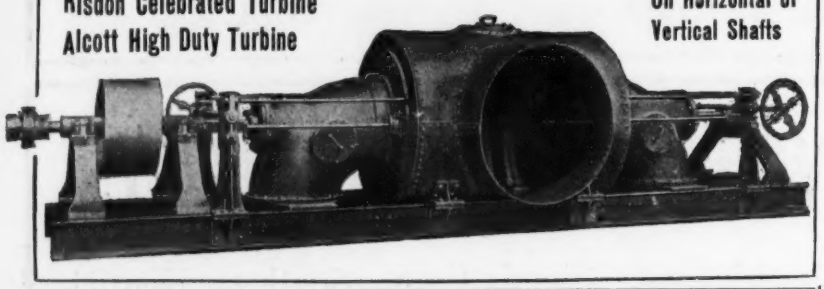

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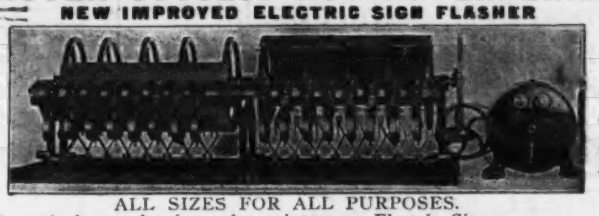

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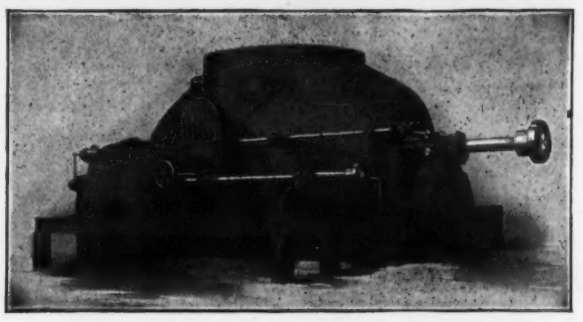

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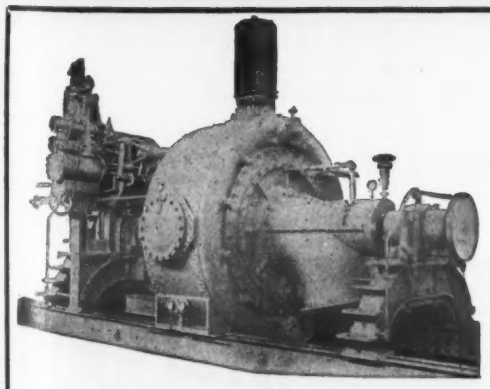

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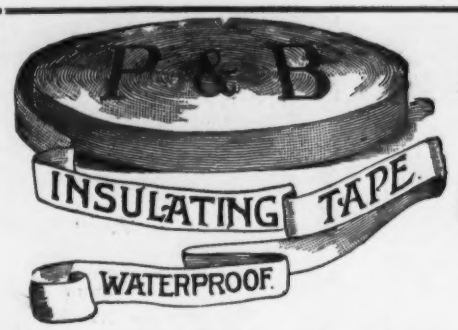


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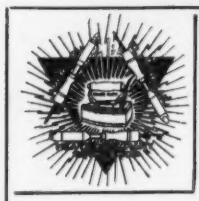

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